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PEPTIC ULCER IN CHILDREN

ROGER L. J. KENNEDY, M.D.
ROCHESTER, MINNESOTA

ULCERS have been found in the stomachs, as well as in the duodenums, of children of all ages. Thus, Schmidt found twenty ulcers in the course of 1,109 postmortem examinations of infants less than one year of age; the majority of those with ulcer were between two and six months of age. In the course of 2,715 postmortem examinations of children of the second year of life or older, seventeen ulcers were found. This gives an average incidence of 1.2 per cent for Schmidt's two groups taken together; of the thirty-seven children, ten had "Pädatrophie" as described by Helmholz and others. Collin reported on 279 cases of duodenal ulcer; four of the patients were less than ten years of age and seventeen of them were in the first year of life. However, I do not know the basis of selection of Collin's material. Theile reported extensively on 244 cases of ulcer of the gastrointestinal tract of children sixteen years of age or younger, and added four cases of his own. Of these 248 patients, 135 were in the first year of life and eighty-three of these in the first month of life. In 119 cases the stomach was affected, alone or together with the duodenum; in 125 cases, the duodenum was affected alone or together with the stomach; in seven cases both stomach and duodenum were affected. In ninety-five cases the ulcers were multiple. Berglund gathered material from records of necropsy in the hospitals of Stockholm. In 1,323 postmortem examinations of children up to thirteen years of age, 70 per cent of whom were in the first year of life, fourteen duodenal ulcers were found, four gastric ulcers, and one combined duodenal and gastric ulcer. In fifty-six cases there were hemorrhagic erosions. Of the nineteen patients with ulcer, six had tuberculous meningitis or syphilis. In one case the diagnosis of ulcer was made and in another it was suspected before death. Usually, the

From Section on Pediatrics, The Mayo Clinic.

lesions were found accidentally at necropsy. Berglund cited Dietrich, who, in 8,534 postmortem examinations, found 134 ulcers or scars of ulcers, six of them in children less than ten years of age, and one of them in an infant aged ten days. Proctor, in 1925, found records in the literature of nineteen cases of chronic peptic ulcer of children. He also reviewed records, available at The Mayo Clinic, of 8,360 cases of duodenal ulcer and 1,596 cases of gastric ulcer. Two of the patients with duodenal ulcer were children; one of those with gastric ulcer was a child. Proctor then wished to determine something of the age of onset of symptoms of ulcer. Accordingly, from his material he took 1,000 cases of gastric ulcer and 1,000 cases of duodenal ulcer. He found that in sixteen of the cases of gastric ulcer and in twenty-six of the cases of duodenal ulcer, symptoms had been present in childhood. It is evident from these figures that ulcers of young persons are not of uncommon occurrence. However, the problem of ulcers of children differs in some respects from that of ulcers of older persons. Subjective symptoms often seem to be absent.

Ulcers in children appear to fall into several rather distinct groups according to the ages of the patients. There is, first, ulcer of the newly born, which makes known its presence by melena neonatorum. This lesion is an acute one which, as pointed out by Helmholz, and by Kennedy, either rapidly heals or else causes death of the infant by hemorrhage or peritonitis. More and more this ulcer is sought for and found in infants who die within a few days following birth, after having had bloody stools. Its recognition has reduced the number of cases of so-called hemorrhagic disease of the newly born.

In the second group are ulcers of children from a few weeks of age to about the end of the first year of life. These ulcers are also acute. Gerdine and Helmholz have demonstrated that they sometimes occur in a restricted geographic region, a fact which gives support to the idea that epidemic infectious causes may be concerned in their etiology. Other infants afflicted are athreptic and of the same age period, when the element of environment appears to play a prominent part.

The peculiarities of the etiology of ulcer following burns, and of those encountered among persons who have suffered cerebral injury such as that resulting from tuberculous meningitis, place such ulcers outside the scope of this article. Obviously, also, the conditions prerequisite for their occurrence are not restricted to any age.

If ulcers of the foregoing types, as well as the acute ulcers of infancy, be excluded from consideration, there remain two other groups.

In the first of these remaining groups are ulcers which are found among children aged one to nine years. These are chronic, in the sense that they may be present for a long time and hence represent more nearly the kind of lesion affecting adults. However, more frequently than otherwise they fail to induce those signs and symptoms which in the

adult lead to the probable diagnosis of ulcer. Thus, as has been emphasized by Dickey in the twenty-five cases which he collected, five were diagnosed at necropsy, eleven at operation, and nine clinically, the diagnosis in several of the latter cases being confirmed at operation. If, however, the cases are limited to those without complication such as obstruction, the proportion of clinical diagnoses becomes even smaller. It is safe to say that among children less than nine or ten years of age the familiar syndrome characteristic of uncomplicated ulcer is usually absent. The signs and symptoms which are present may be few or many, but are so diversified as to rob them of pathognomonic significance. However, cases have been recorded with some of the usual features of ulcer. In several of these one or more of the commoner types of complication have developed, and these have been sufficiently characteristic to render the diagnosis of ulcer either highly probable or certain. For the most part, however, the symptoms of ulcer in this age period are indefinite, so that it is impossible to construct a clear-cut syndrome.

After nine or ten years of age, and particularly by the time of puberty, the second group of cases is encountered. In these peptic ulcer usually assumes its characteristic features, and may be recognized (and treated) according to the established procedures applied to adults.

Six cases which I have studied serve to bring out some of the features of duodenal ulcer of children beyond the age of infancy.

REPORT OF CASES

CASE 1.—A girl was aged four years at the time of her first visit to the clinic, February 4, 1931. The complaint was weakness and loss of weight.

For the year preceding this visit, at intervals of about a month, she had spells of emesis, headache, pain in the abdomen, and fever. These attacks endured one and a half to two days; the most recent attack had lasted about one week. The pain was in the epigastrium. It sometimes occurred about 9 P.M.; sometimes later. Ingestion of orange juice, emesis, and the use of a hot water bottle resulted in some relief of pain. Vomiting occurred repeatedly during an attack. After an attack she was weak and there was some diarrhea with light colored stools. Occasionally, some frequency and urgency of urination accompanied the attack. Between these spells of abdominal discomfort and emesis the girl felt perfectly well.

Physical examination on admission was negative. Three days later a moderate degree of jaundice appeared, and the liver was definitely palpable. The tonsils were large, reddened, and fibrous. The value for hemoglobin was 67 per cent; erythrocytes numbered 4,690,000 in each cubic millimeter of blood. All other laboratory procedures gave negative, or normal, results except roentgenographic and fluoroscopic examination of the stomach, which revealed a characteristic deformity of the duodenum. The stool contained no blood.

The girl was placed in hospital, a diet for ulcer was prescribed, and she was given 10 grains (0.65 gm.) of calcium carbonate every four hours for six doses, and also bromides. She was sent home to follow this regimen.

In March, 1932, she had an infection of the upper part of the respiratory tract, and another on April 14, 1932, a year after her first visit. In association with these she had epigastric pain, nausea, fever, and diarrhea.

She was readmitted to the hospital July 22, 1932. Three days before admission fever, restlessness, anorexia, and diarrhea had developed. At the onset, stools had numbered six or seven a day and had contained much mucus and an occasional shred of bloody mucus. With administration of camphorated tincture of opium, the diarrhea had subsided. On the day of admission the girl vomited and passed one loose green stool containing much mucus but no blood. The vomitus contained undigested food and a small amount of blood. There was no abdominal pain and no jaundice. The rectal temperature was 100.2° F. The tonsillar pillars were reddened and inflamed. Examination of the abdomen and of the blood gave negative results. The stool contained no gross or occult blood. The girl was dismissed from the hospital three days after admission.

August 24, 1932, she was examined preliminary to tonsillectomy and adenoidectomy. She had had only slight occasional melena. Except for the appearance of her tonsils, examination revealed nothing of note. Tonsillectomy and adenoidectomy were performed August 27, 1932.

The girl has since had one transitory spell of abdominal discomfort.

This may be considered one of the more exceptional cases, since at an early age, four years, the history of epigastric pain, occurring at night as well as in the day time, and relieved by taking of orange juice, by emesis, and by application of a hot water bottle, was sufficient to arouse a rather strong suspicion of the presence of ulcer. The features of headache, fever, and diarrhea and the episode of transient jaundice might have been misleading. Although this patient has cooperated well and has improved to a great extent, it is evident that the lesion retains some activity and is not entirely under control.

CASE 2.—A girl aged six years was admitted to The Mayo Clinic, December 27, 1932, with a complaint of stomach ache which she had had for the past year.

The mother had complained of herself having some indefinite stomach trouble and was known to have a gonorrheal infection. The patient was the only child. The mother had not had any miscarriages. The father had died from gas poisoning.

The patient had had attacks of pneumonia at four months, seven months, and twenty-seven months of age. She had undergone tonsillectomy and adenoidectomy in 1932. A year and a half before admission the physician at the patient's home had discovered gonorrheal vaginitis.

A year before the patient was brought to the clinic she had begun to complain of headache and stomach ache occurring ten to fifteen minutes after eating, and lasting ten to thirty minutes. She occasionally had vomited after eating, and occasionally pain had returned in the night. The pain had been mostly in the region of the umbilicus and in the right hypochondrium. A week before admission she had had a high fever, apparently with icterus, and considerable pain, although with no colic. The stools had not been acholic, although the mother thought that the urine was unusually dark in color. Eight months before admission the girl had vomited and the vomitus had contained large amounts of blood. There was no epistaxis at the time and this was the only instance in which blood had been vomited. For the two weeks before admission at the clinic there had been pain and swelling of the right nipple.

Physical examination disclosed that the child was in a good state of nutrition. There was no icterus. There was a watery vaginal discharge without evidence of

irritation. The region of the right nipple was hard and infiltrated. There was a slight trace of albumin in the urine. The Wassermann test was negative. The value for hemoglobin was 82 per cent. Erythrocytes numbered 4,030,000, leucocytes, 3,400 and platelets 76,000 in each cubic millimeter of blood. The proportion of reticulated cells was 0.5 per cent. There was insufficient microcytosis to suggest hemolytic jaundice. Roentgenograms of the thorax were negative as was the tuberculin test. Neisseria gonorrhoeae were present in the vaginal smear. The fragility of erythrocytes was normal. Roentgenographic and fluoroscopic examinations of the stomach gave evidence of a duodenal ulcer.

The child was placed in the hospital and a modified Sippy diet was prescribed with one and a half ounces (45 c.c.) of milk every hour and 5 grains (0.3 gm.) each of sodium bicarbonate and calcium carbonate one hour after meals. Mineral oil was given at night and a teaspoonful of mucin in malted milk at 4:30 P.M. and in the morning. The condition of the nipple did not subside entirely during the period of observation. The child was dismissed, to continue on the outlined regimen.

This case is unusual because of the rather typical history obtained from so young a patient. It is not thought that the gonorrheal infection was in any way related to the duodenal ulcer. The patient has not been under observation for a sufficiently long period for the effect of treatment to be determined.

CASE 3.—A girl was aged eight years at the time of admission October 27, 1927. Her complaint was of irregular epigastric pain for three years past. She had had several of the contagious diseases and tonsillitis.

Her illness dated back three years, when she had begun to complain of epigastric pain at irregular intervals. The pain was dull, appearing one to two hours after meals, was present at night, and had been increasing in constancy. At the time of admission it was present after nearly every meal and almost every night. Occasionally, nausea and emesis occurred during the attacks, which usually lasted two to three weeks. With the last attack there had been diarrhea and fever. The appetite had remained good and movements of the bowels, regular. There had been no melena nor hematemesis.

Physical examination disclosed that the girl was 5 pounds or 2.3 kg. (10 per cent) underweight. There were carious, deciduous teeth. Urinalysis, examination of blood, and roentgenography of the thorax gave negative results. Total acidity of gastric content was 54, and free hydrochloric acid, 38 (titrated against tenth normal solution of sodium hydroxide). There was no blood, bile, or mucus in the gastric content. Roentgenographic and fluoroscopic examination of the stomach gave evidence of duodenal ulcer.

A modified Sippy diet was prescribed, together with alkali. For two and a half years the girl remained on the diet and was free from symptoms. Then, for the following year, she did not follow the diet, and had two slight attacks of pain following severe exercise. She attended school regularly.

She was seen again April 6, 1931, three and a half years after starting on the diet. For the two previous weeks she had not been well. She had vomited once, and in the morning, at irregular intervals, had had epigastric pain of increasing severity. The pain was relieved by a drink of milk. She was eight pounds or 3.6 kg. (11 per cent) underweight. There was a point of rather marked tenderness in the epigastrium to the right of the median line. Roentgenographic examination

gave evidence of a duodenal ulcer, with some evidence of beginning obstruction. A soft diet, with milk between meals, was prescribed. Three months later the girl reported improvement. There was some distress at night, for which milk was required, but no definite attacks of pain. Recent inquiry revealed the fact that the girl had been practically free of symptoms, with the exception of one or two slight attacks. Now, her diet is only moderately restricted.

The case just reported may be considered one of duodenal ulcer presenting a typical history and requiring only the confirmation of the roentgenologist to establish the diagnosis with certainty. On the other hand, as in cases of ulcer of adults, roentgenologic investigation cannot invariably be depended on, although the error of the method is small in cases in which ulcer is present. A discrepancy between clinical and roentgenologic findings is exemplified in the next case.

CASE 4.—A boy, aged eleven years at the time of admission on March 11, 1930, complained of nausea and abdominal pain of five years' duration.

The onset of his trouble had been sudden. Five years before, he had had a sudden attack of nausea, with pain in the abdomen and fever. Castor oil had been given him. Within two to three days he had recovered. Following this he had had attacks of pain and nausea at intervals of about two months. The pain would last only a few minutes and would recur several times a day. Occasionally there had been slight emesis. This had continued until 1926, one year after onset, when appendectomy had been performed. Several months of freedom from discomfort had ensued. Then, similar attacks had begun to recur and had increased in frequency. The pain was in the center of the abdomen, was usually accompanied by vomiting, which relieved the pain, occurred almost every day in attacks lasting about a half hour, and had no relation to type of food or to meals. On direct questioning the boy stated that he thought an occasional stool had contained black, tarry material.

He was 5 pounds or 2.3 kg. (7 per cent) underweight. He had one carious tooth. The abdomen was negative to examination. Urinalysis, the Mantoux test, and examination of blood, including the Wassermann test were negative. Roentgenographic and fluoroscopic examination of the stomach, and roentgenograms of the thorax and colon were negative.

On account of the increasing number of attacks, exploration of the abdomen was carried out March 15, 1930. The stomach at the time of operation seemed dilated. There was a subacute, duodenal ulcer, situated at the pyloric ring, producing moderate obstruction and associated with extensive duodenitis. Excision or pyloroplasty was deemed impossible. Posterior gastroenterostomy was performed. Uneventful recovery followed, and the patient has remained well to the present time.

The reason for the negative roentgenographic report of the stomach and duodenum in Case 4 is clear, but the fact remains that other considerations were of sufficient importance to lead to exploration and discovery of the duodenal ulcer. The method of treatment elected was not unusual, for gastroenterostomy and other operative procedures have been applied to patients even much younger, who have had complications of peptic ulcer. Case 5 illustrates a set of conditions the reverse of those encountered in Case 4.

CASE 5.—A boy, aged nine years, was seen first February 22, 1932 because he had had pain in the right side of the abdomen for the previous two months. The family history and previous personal history were negative.

Two months before admission he began to complain of pain in the right side of the abdomen immediately following a full meal. The pain was sharp and constant, and lasted a half hour. The pain was relieved by assuming the recumbent position. There was occasional nausea but no emesis. The appetite was good, the bowels regular.

Examination disclosed that the boy was 3 pounds (1.4 kg.) overweight, and had vasomotor rhinitis. Otherwise, physical examination was negative. Examination of the blood, including the Wassermann reaction, and of the urine and stools, gave negative results. The Mantoux test, and roentgenologic examination of the thorax were negative. Roentgenographic and fluoroscopic examination of the stomach gave evidence of a duodenal ulcer.

The boy's father, a physician, had sent the boy to the clinic for appendectomy. At operation, February 24, 1932, the stomach was found to be normal in size and appearance. The pylorus was wide open. No stippling of the first portion of the duodenum and no evidence of ulcer were found. The duodenum was not opened. The appendix was long, retrocecal, chronically inflamed to moderate degree, and contained some concretions. Appendectomy was performed. The pathologic report was chronic catarrhal appendicitis.

Roentgenographic and fluoroscopic examination of the stomach was repeated March 10, 1932, two weeks after operation. The same deformity of the duodenum was found, and again was interpreted as duodenal ulcer, the history being withheld from the roentgenologist, with his consent.

It was apparent, in this case, that in spite of exploration of the duodenum, the presence or absence of ulcer remained in doubt. In attempting to decide the question, consideration of the history pointed to the appendix as the seat of trouble rather than to a duodenal lesion. The pathologic appearance of the appendix did not decide the question. In the opinion of the surgeon the duodenal deformity found in the roentgenogram was caused by spasm or possibly by an ulcer of the posterior wall. The only way of settling the matter definitely would have been by opening the duodenum, but it was thought at the time that such a measure was not indicated. Nevertheless, persistence of the deformity after operation makes the presence of ulcer a possibility, and one which demands further observation of the patient.

CASE 6.—A girl, aged ten years, was admitted to The Mayo Clinic, November 18, 1932, because of acute, right suppurative otitis media and mastoiditis. The mother had been known to have a gastric ulcer for the three previous years.

The patient was the only child. She had had tonsillitis, and the tonsils and adenoids had been removed in 1929. She had also had measles, whooping cough and chicken pox. The aural difficulty dated from an attack of scarlet fever eight weeks before she was presented for treatment. This attack was followed by earache, spontaneous drainage from the ear, and finally acute mastoiditis. Complete right mastoidectomy was performed, from which recovery was uneventful.

After the girl had left the hospital, one night about 8 o'clock some epigastric distress and vomiting developed. The vomiting was repeated several times in the night and twice in the following morning. The epigastric discomfort continued throughout the night. Further questioning elicited the information that she had had

attacks of epigastric pain accompanied by vomiting for the three previous years. These had occurred two to three times yearly and had lasted for from one day to several days. They occurred without relationship to meals. She had never been given soda. Although the mother stated that the child usually had fever with these attacks, the temperature was normal during the attack in which she was observed. Her physical condition was good. There was slight tenderness about 2 inches (5 cm.) to the right, and slightly above the umbilicus. Roentgenographic and fluoroscopic examination revealed the presence of a duodenal ulcer. The girl was again placed in hospital and a modified Sippy diet was prescribed, together with alkalies, two times daily, an hour after meals, and 1 teaspoonful (4 c.c.) of mucin was given in malted milk at 10:30 A.M., at 4 P.M., and at bed time. The child was dismissed to continue on this regimen. While she was in hospital, some tenderness was elicited in the lower right abdominal quadrant, and the diagnosis of duodenal ulcer possibly associated with mild appendicitis was made.

As in Case 5, the history in Case 6 could only arouse suspicion of the presence of ulcer. On account of mastoiditis, for which the girl was brought to the clinic, the history of abdominal discomfort did not stand out prominently, and it was only because she suffered one of her acute attacks of abdominal pain that the gastrointestinal study was made. She, too, has been under observation for too short a period of time to judge what the effect of treatment may be.

COMMENT

The etiologic factors responsible for these ulcers probably do not differ greatly from those thought to be operative in causation of ulcer of older persons. There is nothing to be gained by reviewing here the arguments having to do with the etiology of peptic ulcer. Suffice it to say that obviously such factors as nervous and emotional strain, nicotinism, alcoholism, and such dietary indiscretions as may be indulged in by adults usually can be eliminated, leaving such factors as infection, vascular accidents and anomalies, and other disturbed physiologic functions as the more likely, although by no means certain, causes. Although infections of various sorts occurred not infrequently in this small group of cases, either preceding or during the time the ulcers gave symptoms of activity, too great etiologic importance cannot be placed on the presence of such infections, since in any similar group of children there might well be an equally high incidence of infection, without the concomitant occurrence of ulcer. It does appear reasonable, however, to eliminate all suspicious foci because of the likelihood of reactivation of symptoms of ulcer by flare-ups in infected tissues remote from the ulcers. For that reason, tonsillectomy was actually performed in Case 1.

From the diagnostic standpoint certain features are emphasized by these cases. Regardless of the age of the child, a complaint of epigastric pain, occurring some time after meals and particularly at night, relieved by ingestion of milk or other food or by emesis, and accompanied by tenderness in the upper right portion of the abdomen, should lead

to a very strong suspicion of peptic ulcer, and should be an indication for roentgenologic examination of the stomach and duodenum by a roentgenologist experienced in gastrointestinal study. Furthermore, indefinite abdominal discomfort, particularly if epigastric in situation, even if unaccompanied by other characteristic symptoms, may be caused by ulcer, and roentgenologic examination is justified. It is this latter type of case which is of particular interest to the pediatrician, since, on account of its indeterminate character, the complaint may be overlooked entirely or else may be classified as one of the type frequently encountered among children of neuropathic disposition. As Proctor has so clearly stated, "The most important single factor in the diagnosis is the realization that chronic peptic ulcer occurs in children."

In some cases in which investigation can be carried no further than roentgenologic study, the finding of a duodenal deformity considered characteristic of ulcer in adults may be open to question as a basis for diagnosis, although there is no good evidence which renders this finding less acceptable in the case of a child than in that of an older person. In the cases presented here, the deformities were no less marked in the atypical cases than in those in which the syndrome of ulcer could be considered as complete in all of its clinical characteristics.

Frequent meals, consisting of bland food, chiefly milk, together with the use of alkali powders, are the essentials of medical treatment. Rest in bed has been prescribed in two of these cases when the ulcers appeared to be especially active; particularly in Case 1 during the time the bleeding occurred. Removal of infected foci appears to be a logical procedure. In only one case was operation resorted to and in that instance evidence of obstruction was marked and demanded relief. There is every reason to think that the indications for treatment of complications which require surgical procedures may be met in much the same manner as they are when patients are older. It is neither practicable nor necessary to make determinations of the amount of acids in the gastric juice as is done in the care of older patients.

SUMMARY

Duodenal ulcers occur at all ages of infancy and childhood. Ulcers of infants up to a year or two of age are usually acute and are most commonly suspected because of melena. In the six cases of chronic duodenal ulcer reported, the children were past the period of infancy. Two of these (Cases 1 and 2) are of particular interest because the histories and the roentgenologic appearance were typical at the early ages of four and six years, respectively. In childhood, and up to the age of puberty, the picture of ulcer may be so clear cut as to make diagnosis relatively simple, or so confused as to render diagnosis impossible except by operation. Roentgenologic examination is the most

dependable single procedure in diagnosis of ulcers of children, but may lead to error by failing to give evidence of ulcer when present, or perhaps by indicating that ulcer is present when it is absent. Indications for medical and surgical treatment of ulcer and its complications in children are essentially the same as in adults. Duodenal ulcer should be sought in children of all ages who have chronic or recurring indefinite abdominal pain.

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MORQUIO'S DISEASE

Presentation of Two Cases

E. J. Barnett, M.D.
Spokane, Washington

In 1929 Morquio[1] of Uruguay described an osseous dystrophy characterized by familial occurrence, dwarfism, changes in the epiphyses, and, in many instances, absence of the heads of the femora. He reported four children in one family affected by this condition. Since that time two additional reports have appeared in the literature. Ruggles[2] reported three children out of seven in one family presenting this deformity, and in another family two children were affected. Just as Meyer and Brennemann[3] had failed to find information about their case of this peculiar condition until Brennemann discovered Morquio's original description, in the same manner we were puzzled about the identical condition in two sisters until we came across the article by Meyer and Brennemann. By that time the family had moved and some of their records were transferred to a second institution.

Over a period of six months these two sisters were patients in the hospital. At every opportunity during that time, but without success, these patients were shown to individuals and groups in the hope that some physician might be found who was familiar with the classification or diagnosis.

Further interest was aroused by these two cases in that the orthopedic surgeon, Dr. A. O. Adams, obtained a specimen of bone for microscopic study at the time he corrected by open operation and with resulting normal healing and union the pronounced genu valgum. The specimen of bone was sent to the Pathology and Research Department of Shriners' Hospitals, St. Louis, Missouri, and the following report was received:

Gross Examination: Specimen consists of a small piece of cancellous bone and a small wedge-shaped cortical bone with the enclosed medullary contents which appear to be cancellous bone with some fatty marrow.

Microscopic Examination: Bone appears to be unusually dense in structure and rather poorly supplied with blood. Otherwise normal.

Diagnosis: Normal bone.

CASE REPORTS

R. S. was thirteen years old at the time she entered the hospital on December 22, with a diagnosis of rickets and achondroplasia. One other sister had the same con-

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From the Shriners' Hospitals for Crippled Children, Spokane Mobile Unit.

Fig. 1.—Before osteotomy.

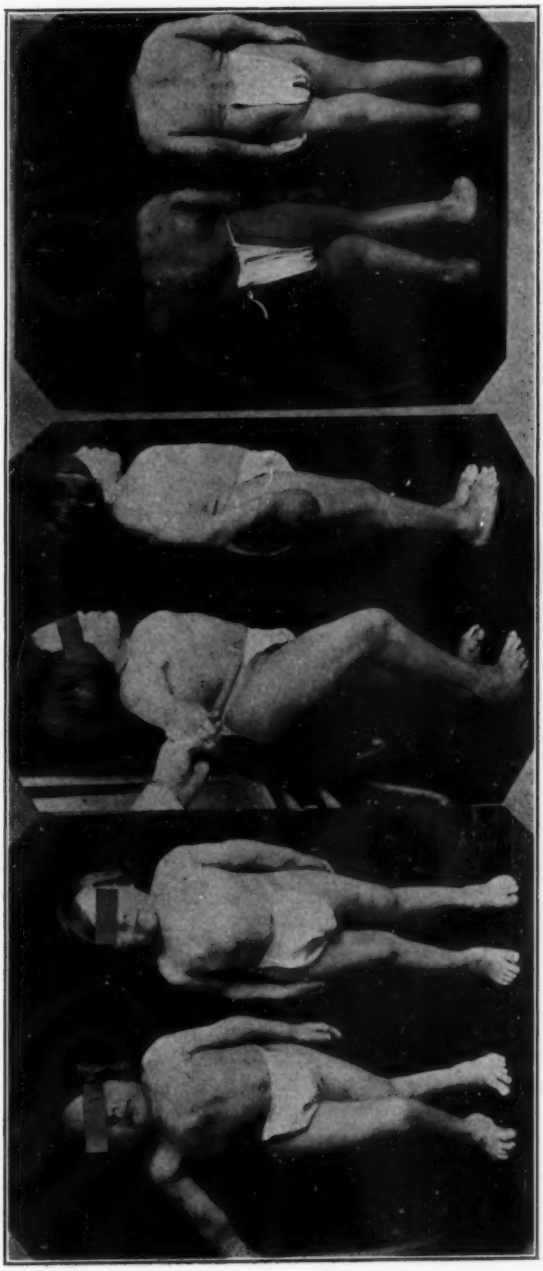

Fig. 2.—After osteotomy.

dition and was admitted at the same time. Both children appeared to have good mentality. Parents and two other sisters were living and well.

At the time of admission the orthopedic examination disclosed a marked dorsal-lumbar kyphosis. X-ray films showed considerable destruction of the heads of the femora, considerable destruction of the acetabulum, and considerable atrophy of the upper end of each femur. The films of the knees showed a marked bilateral genu valgum deformity with the joint surface roughened and with considerable bony proliferation. In the wrists the centers of ossification were present but greatly retarded. The radius and ulna were bowed.

The head appeared large and the occipitofrontal circumference was 21¼ inches. The forehead was prominent and the bridge of the nose was depressed. The sternum was prominent. The genu valgum on the left side was so pronounced that

Fig. 3.—(R.) Roentgenograms of the knees—showing deformity, changes in epiphyses, and roughening of joint surfaces.

the right knee was pushed forward to a marked extent. The wrists and ankles were large. The muscles seemed weak. Wassermann was negative. Blood calcium was 8.

On January 21 osteotomy of the right femur was performed.

An x-ray on February 22 showed an osteotomy about 1½ inches above the lower femoral epiphyseal line with fragments in good position but with only a moderate amount of callus formation. On March 20 the x-ray showed a satisfactory amount of callus.

On April 8 osteotomy of the left femur was performed.

When discharged June 26 the knee deformity was considerably corrected.

S. S., ten years old, presented the same deformities as her sister, but to a less degree. On January 21 an osteotomy of right femur was performed and at the time of osteotomy of left femur on March 4 a specimen of bone was taken for examination.

COMMENT

The similarity in the photographs of the cases in the preceding three reports to our two cases is striking and the available case reports are almost identical. In fact, all of these unfortunate children seem to be members of one peculiar family or race.

It can be seen from the photographs that the children are short, the eyes are widely separated, the nose is depressed, the neck is short, the sternum is so pushed and bent forward that it appears as a "shelf upon

Fig. 4.—(R). Roentgenogram of pelvis—showing absence or destruction of the heads of the femora, and destructive changes in the acetabulum.

which the chin rests," the spine is kyphotic, the hips are flexed so that the children appear to crouch, the hands extend almost to the markedly knocked knees, the feet are kept apart, and the ends of the long bones are prominent.

That these cases present a clinical entity is evident. The familial tendency is also quite evident. The deformities are almost identical, and yet are different from other classified types of hereditary deforming cartilaginous or osseous dystrophies.

SUMMARY

Two sisters are reported with unusual identical deformities. Three other reports of an identical condition are available. Marked generalized epiphyseal disturbance and abnormal cartilage growth are present.

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PAULSEN MEDICAL BUILDING.

BODY BUILD AND ITS RELATION TO GASTRIC POSITION, FORM, SECRETION, AND MOTILITY AND TO GASTROINTESTINAL EMPTYING RATE

WALTER J. SIEMSEN, M.D., AND ALFRED C. LEDOUX, M.D.
CHICAGO, ILLINOIS

DIFFERENCES in body build have attracted widespread interest among laymen and scientists for many centuries. As Bryant[1] has pointed out, the matter is brought to the attention of the child at an early age by such rhymes as that concerning Jack Spratt and his wife. Comic strips depicting characters as Mutt and Jeff also entail body build. In industry and in athletics body build is of no small importance as different types are best adapted to certain types of work and sport (Goldthwait[2]). Body build and its significance morphologically, biologically, physiologically, immunologically, psychologically, and pathologically have been the subject of numerous and extensive investigations (Stiller,[3] Mills,[4] Schiff,[5] Schlesinger,[6] Baráth,[7] Borchardt,[8, 9] Stheeman,[10] Lubowski,[11] Goldthwait,[2] Gerber,[12] Bausi, Groscurth and Weigel[13]). Thus Bryant[1] has listed 178 points of difference between persons of narrow and broad build. Much of the literature concerning body build is confusing, because of the almost synonymous use of terms like habitus, constitution, diathesis, disposition, and because of the numerous and varied classifications of body type.

Goldthwait[2] contended that a study of comparative anatomy is essential to a proper understanding of differences in body type. He refers to the similarity between the slender human type and carnivorae and between the broad human type and herbivorae, stressing among other findings the relative length of the intestine in the two types. Considering the variations in type among herbivorae as represented by race horses and draft horses and among carnivorae as represented by hounds and bulldogs, the similarity as regards body build seems of limited applicability.

While heredity is generally conceded to be of great importance in body build, other factors are alleged to play a rôle. Kellog[14] states summarily that heredity and environment determine the structural, physiologic, and psychologic character of every individual. Nationality and race are regarded as significant by Weckenbach[15] who found a predominance of the asthenic constitution among the Frieslanders of Holland, and of the apoplectic constitution among Alsatians. While admitting the likelihood of the influence of racial and environmental factors

From The Department of Pediatrics and The Division of Roentgenology, The University of Chicago Clinics.

as climate and altitude, Engelbach[15] made the sweeping statement that the function of the ductless glands fundamentally governs those processes which produce statural characters and physiologic function. Habits of eating should probably also be considered. The question of etiology in body build is of interest per se and also because of its bearing on the matter of classification.

Even when classifications not strictly morphological, as that of Sigaud[16] and his pupils, are left out of consideration, the problem of classification is fraught with difficulties. The simplest classification is that including only two types: the slender and the broad (asthenic or leptosome, and pyknic or eurosome types of Kretschmer[17]). A more comprehensive classification includes three types: the slender, the medium, and the broad (dolichomorph, mesomorph, brachymorph of Serebrowskaja[18]; asthenic, normosthenic, hypersthenic, of Tschernorritzky[19]). Even the more elaborate classifications which include subtypes of the two or three major types as those of Mills[4] and Brugsch[20] are lacking in adequacy because of the relative scarcity of pure types.

In determining the type to which an individual belongs the visual or subjective method and the anthropometric or objective method together with evaluation of certain morphologic signs may be employed. Mills[21] has called attention to the value of photography. While evaluation of type by anthropometric measurements and indices eliminates subjectivity it is not infallible as is evident from studies of various authors (Serebrowskaja,[18] Helmreich and Kassowitz,[22] Schlesinger,[6] Hanchman[19] and others). Butler[23] in speaking of one type of habitus expressed the opinion that "there is no index or sign that is pathognomonic of this habitus. In fact adherence to such points in the study of this subject interferes with a clear conception of it."

BODY TYPES IN CHILDHOOD

While the difficulty in classifying adults is great, the difficulty encountered in classifying children is greater. To the difficulty provided by mixture of types is added the difficulty of proper evaluation of changes occurring in the growing child. Although Goldthwait[2] expressed the belief that type is present at the time of birth, the detection of type may be none the less difficult. The marked changes in body proportions from infancy to adulthood have been pointed out by Stratz.[24] Various authors (Schlesinger,[6] Serebrowskaja,[18] Helmreich and Kassowitz[22]) have mentioned a change in habitus after the fifth year of life. Smith[25] thinks the change occurs later. Butler[23] quoted Stratz's enumeration of four growth periods: "(1) a first period of fullness from infancy up to the fifth year; (2) a first period of stretching out or elongation, extending from the fifth to the eighth year; (3) a second period of fullness from the eighth to the eleventh year; (4) a second period of stretching out from the eleventh to the fourteenth year." Ac-

cording to Schlesinger[6] and Gottstein and Gottstein-Schenk[26] social status may play a rôle in type determination. The prepubertal and pubertal periods of rapid growth are conceded to be of importance (Serebrowskaja[18] and Schlesinger[6]). Serebrowskaja[18] refers to the prepubertal age as the age of physiologic asthenia of Grusdjev. Schlesinger[6] has called puberty the period of most slender body build. Gottstein and Gottstein-Schenk[26] warned about the necessity of care in avoiding confusion between transitory and permanent types.

Of all the types described the slender or "asthenic," also commonly designated by the term "asthenia universalis congenita, Stiller" in tribute to Stiller's classical work of 1907 ("Die asthenische Konstitutionskrankheit: asthenia universalis congenita, morbus asthenicus") has probably received the most attention. Unfortunately the term asthenia is enormously general, glibly used, and much abused even in its limited application to habitus. A composite picture of this type as given by various authors (Stiller,[3] Abt,[16] Mills,[4] Goldthwait[2]) is as follows: frail slender physique; small face with delicate features; long thin neck; relatively long, shallow, usually narrow chest with an acute downward course of the ribs and a narrow epigastric angle; forward position of the shoulders with prominent clavicles and scapulae; narrow upper abdomen, prominent lower abdomen, slender hands and long tapering fingers. As characteristic signs of the habitus Stiller[3] stressed the floating tenth rib and the narrow epigastric angle. Mills[4] emphasized the absence of the xyphoid. However, as pointed out by Abt[16] and Butler[23] undue emphasis on signs and stigmata is probably unwarranted. Abt[16] stated that the asthenic habitus is seen in its typical form in children of school age and before puberty. Sauer, Minsk, and Alexander[27] also speak of children being of the asthenic habitus. Many of the children described by Seeham[28] and as suggested by him probably belong in this group.

The antithesis of the slender type is seen in the broad type of body build with a round head, short, thick neck; square shoulders, high, wide and deep chest; relatively long abdomen, large in its upper portions, and chubby hands.

Because of the differences of architecture in the different types and because of an apparent tendency to endogenous leanness in the slender type and to an endogenous obesity in the broad type, difficulties to be expected in attempting conformance to optimum weight "standards" are obvious. The slender type is probably least conforming. The inadequacy of so-called standard weight tables and the desirability of consideration of body build in predicting optimum weight has been pointed out by various authors (Faber,[29] Dublin and Gebhart,[30] Engelbach,[15] Kornfeld,[17] Gray,[31] Helmreich and Kassowitz[22]). Du Bray's[32] statement, "a truly comprehensive formula must take into consideration

the following factors: age, height, sex, and *body build,*" is in agreement with the note accompanying the weight, height, age tables of Baldwin and Wood issued by the American Child Health Association. The note reads in part as follows:

> Individual children of the same age and height *normally* show wide variation in weight due principally to the width and depth of the skeletal framework. Body width and depth are as important as height in determining body weight. This fact should be borne in mind in interpreting the *significance* of deviation from average weight for height.

The orthopedic aspect of body build is interesting. In the slender type the skeleton is gracile and delicate; in the broad type it is heavy. According to Goldthwait[2] the relatively long torso in the slender type is accounted for in part by the thorax but chiefly by the lumbar spine which frequently is composed of six vertebrae. The peculiar structure of the lumbar vertebrae permits greater flexibility and among the slender types are found fancy dancers, hurdlers, and acrobats. In the broad type the lumbar spine is shorter, frequently consisting of only four vertebrae. The structure of the lumbar vertebrae is such as to limit flexibility quite decidedly.

In addition to skeletal peculiarities, other orthopedic factors play a rôle in body build. Various authors have stressed the laxity and hypotonia as being characteristic of the slender or asthenic types. Stiller[3] in describing the "asthenic constitution" mentioned laxity and atony as fundamental characteristics, and ascribes them to deficiency of the chromafin system. Borchardt[8] speaks of "Schlaffe constitution" and status asthenicus synonymously. Conran[32] suggested the term "hypotonic diathesis" as more descriptive and more etymologically correct than the term "asthenia." Laxity of the connecting apparatus of the skeleton may lead to scoliosis, coxavara, genu valgum, pes planus, etc. (Borchardt[8]). Laxity of skeletal muscles also may cause or enhance the disturbances of posture and reversely posture is said to influence muscle tone (Seward[34]). Goldthwait[2] has stated that posture indicates to a large extent the type of individual. He pointed out that in the slender type an accentuated lordosis is seen in the lower lumbar region while in the broad type a lordotic curve is seen in the dorsolumbar region. Pelvic inclination is consequently greater in the slender type. Gravity is obviously of great importance in posture. To it is ascribed the flat chest and to some extent the prominence of the lower abdomen. Bryant[35] has called attention to the importance of the oblique and transverse abdominal musculature as well as the recti in determining the shape of the abdomen. Pembrey[36] has suggested that decreased tone and the large span of the abdominal muscles may be significant.

BODY TYPE AND VISCERAL RELATIONSHIPS

The type of body build and posture are of no small importance in determining the internal configuration of the abdominal cavity. And as Seward[34] has pointed out "the shape of the abdominal cavity largely determines the position of the viscera." A chest of small circumference implies smallness of the upper part of the abdomen with consequent downward displacement of the viscera. The importance of chest size has been stressed by Bryant,[35] and by Campbell and Conybeare.[36] Bryant suggested that the level of attachment of the diaphragm may be important. And Fitts[37] states that the excursion of the diaphragm influences the size and shape of the abdomen. Some authors (Goldthwait and Brown,[38] Wheatley and More[39] and Bortz[40]) consider faulty posture a cause of visceral malposition. Sever[41] on the other hand, thinks posture has been much overestimated.

If the degree of visceral displacement is marked the condition is called visceroptosis or enteroptosis, also Glenard's disease, because of his excellent treatise on the subject as early as the third decade of the nineteenth century. Visceroptosis or enteroptosis has been the subject of controversy for many years. Einhorn[42] defines the condition as "a condition in which most of the organs of the abdomen have slipped down more or less and are out of their normal position." Cases of visceroptosis have been classified as congenital and acquired (Beilin,[43] Bortz,[40] Butler,[23] Fitts[37]). Congenital cases are commonly referred to as being of the "enteroptotic" or "visceroptotic" habitus the description of which coincides with that of asthenic habitus. Butler is convinced that evidences of enteroptotic habitus are observable throughout childhood, being more prominent as the age of puberty is reached. He thinks that with the development of puberty fully one-third of all girls and one-sixth of all boys are of the enteroptotic habitus. The preponderance of the condition in females is in accord with the findings in adults. Smith[25] expressed the opinion that the enteroptotic habitus of the adult has its counterpart in the frail child. While Wright[44] reports palpable abdominal organs in children in more than 20 per cent of cases, Smith[25] reports a palpable kidney in less than 3 per cent and quotes Butler as having found it in 6 per cent. In acquired cases various etiologic causes are given as loss of weight, overwork, worry, debilitating disease, lack of exercise (Bortz[40]). Conran[33] lists in addition, childbearing and excessive exercise. Subnutrition with lack of supporting intra-abdominal fat is generally conceded to be of importance as an etiologic factor. This factor would seem to be of importance in congenital as well as in acquired cases. Butler[23] states that children in whom the enteroptotic habitus is seen usually give a history of continued undernutrition.

As Goldthwait[2] has pointed out, the influence of gravity plays no small rôle in enteroptosis. He refers to enteroptosis as one of the penalties of the biped nature of man. Gravity exerts a particularly harmful influence on the viscera in the case of the asthenic individual because of the laxity of supporting structures and their semblance to those found in quadrupeds. Tension on the diaphragm and on its chief supporting ligament, the cervical fascia with its extension in the right side of the pericardium (Goldthwait and Brown[38]) causes "drop heart" and disturbances of posture. "Drop heart" is supposedly especially common when the liver is ptotic—Einhorn.[42]

Of particular interest is the position of the stomach and of the colon. Goldthwait and Brown[38] have pointed out that while the transverse colon as a rule furnishes a sling-like support to the stomach, it may drag the stomach down if it has a free mesentery. In any event the level of the stomach and colon usually correspond. According to Bortz[40] the term "gastroptosis" is a misnomer for as he and others have pointed out prolapse of the stomach does not occur because of fixation of the pylorus and cardia. Here again body build cannot be left out of consideration. Beilin[43] states that the position of the stomach in part at least depends on the inherited constitutional frame. Campbell and Conybeare[36] also stress the influence of the shape of the trunk on the position of the stomach. Bortz[40] has called attention to the fact that a long stomach is the rule in a long body, and Seward[34] expressed the opinion that a diagnosis of ptosis is unwarranted unless the body habitus is considered. Mills[4] found the relation between body build and gastric position fairly consistent in the adult. While Wright[44] found this relation to exist to some extent in the child, Sever[41] was unable to establish a relation between the shape of the chest and the degree of ptosis. Since the advent of x-ray examination of the gastrointestinal tract considerable light has been shed on gastric position and the impression has been gained that the "normal" position of the stomach is considerably lower than was formerly thought.

Beilin[43] states that in adults the lowest part of the stomach is normally 2-7 cm. below the interiliac line and that in cases of clinical gastroptosis it is on the average 9 cm. below the interiliac level. Moody[45] found the greater curvature of the filled stomach below the interiliac line in 80 per cent of men and 95 per cent of women. With the stomach practically empty he found the percentage for men 50 and for women 85. Comparing his results with those of a study carried out on healthy young adults at the University of Chicago in which the lowest level of the greater curvature was found below the interiliac plane in 75 per cent of men and 88 per cent of women, he concludes that the stomach apparently occupies a lower level in British subjects than in Americans. He states further that in British subjects the greater curvature was

found more than 2 inches below the interiliac level in 31 per cent of men and 57 per cent of women as compared to a similar finding in 43 per cent of American women. It is generally conceded that "gastroptosis" is more common in women than in men.

The vertical position of the stomach is greatly preponderant. Simmonds[46] noted that the stomach assumes a vertical position in 75 per cent of cases as soon as the child stands up and walks. Reports on the position of the stomach in the child vary. Smith[25] found the stomachs of 109 children "well up in the abdomen" with the exception of one case which showed moderate prolapse. He states that Butler found no stomach below the umbilicus until after the twelfth to the fourteenth year. Wright[44] on the other hand reports that a study of 250 children revealed the stomach above the interiliac level in 42 per cent, at the level in 16 per cent and below the level in 42 per cent. He states that variation in position increased with age and that after eleven years there is a distinct tendency to lower position in girls. Sever[41] studied 83 children four to eighteen years of age and found the lower border of the stomach at the level of the fourth lumbar vertebra in 25; at the interiliac level in 9; well below, frequently 3 to 4 inches, in 49. According to Kerley[47] enteroptosis is a common finding in children.

Corresponding to variations in position of the stomach are variations in form. In the horizontal stomach as is seen during infancy the steer horn or retort form is the rule. According to Smith's[25] findings this type prevails until three years of age. In older children and in adults the predominant vertical position is accompanied by a more tubular form with a fish-hook shape at the lower pole.

Attendant upon variations in position and form of the stomach and corresponding to variations in body build, differences in gastric function are alleged to occur. According to Wagoner[48] the normal negative intraabdominal pressure is increased in the splanchnoptotic when the upright position is assumed, returning to normal in the recumbent position. With increased negative intraabdominal pressure peristalsis is diminished and loss of tone and gastrointestinal stasis may result. Various authors have reported disturbed or decreased motility or atony and delayed emptying time of the ptotic stomach (Stiller,[3] Mills,[4] Conran,[33] Albu,[49] Bortz[40]). Mills[4] reported delayed emptying time of the stomach and reduced tone of the entire gastrointestinal tract in the slender types of individuals. Stiller[3] stated that the stomach of the asthenic shows motor lability and may show all grades of atony with the finding of clapotage. Kerley[47] reported delayed emptying of the stomach in children with enteroptosis, and Sauer, Minsk and Alexander[27] found increased gastric emptying time in children of the asthenic habitus. Rupp and Schlutz[50] reported hypomotility of the empty stomach in asthenic children.

Fig 1 Case 1

Fig. 2 Case 2

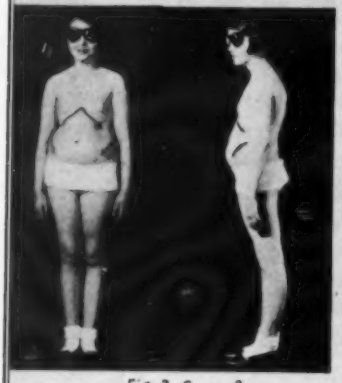


Fig. 3 Case 3

Fig. 4 Case 4

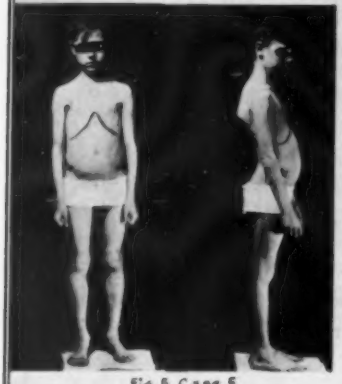


Fig. 5 Case 5

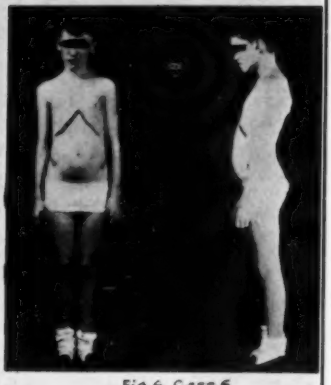


Fig 6 Case 6

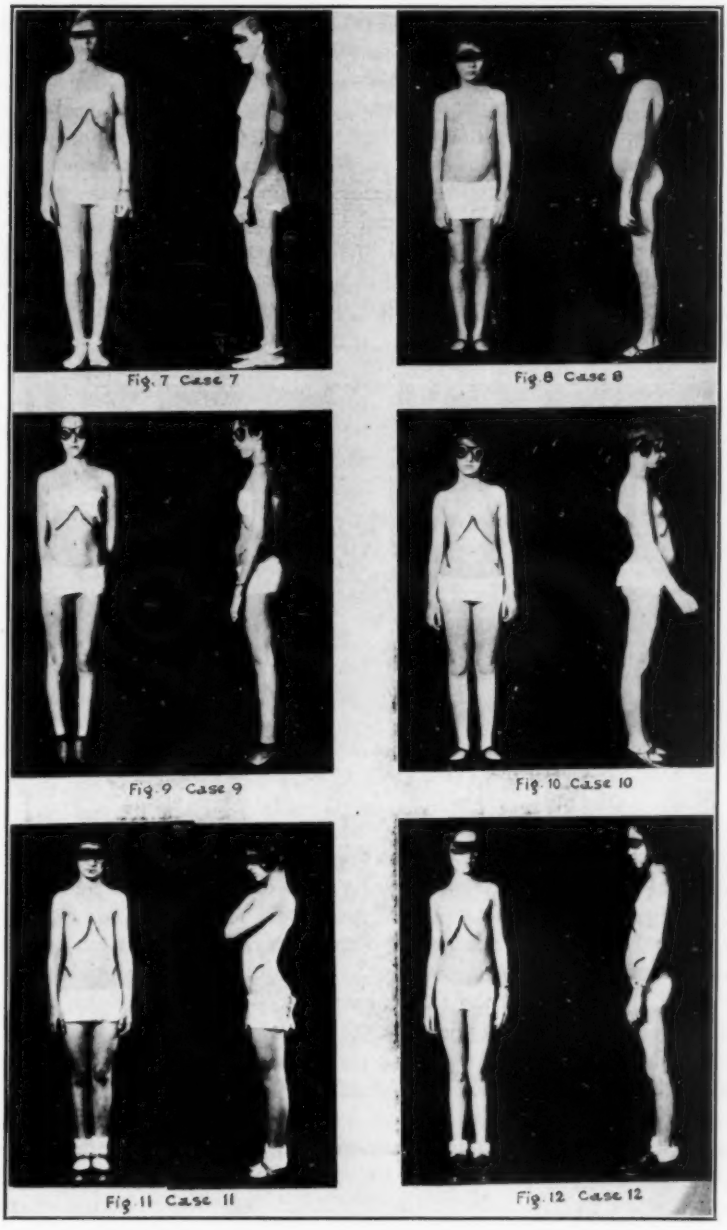


Fig. 7 Case 7

Fig. 8 Case 8

Fig. 9 Case 9

Fig. 10 Case 10

Fig. 11 Case 11

Fig. 12 Case 12

While some authors describe a relation between body build and gastric position, gastric motility, and gastric secretion, reports vary considerably. Mills[4] is of the opinion that gastric acidity is lower in the slender types than in the broad types. Baird, Campbell and Hern[51] see a relation between a relatively short broad chest and hyperacidity and between a relatively long narrow chest and hypoacidity. Stiller[3] states that hyperacidity predominates in the asthenic. Sauer, Minsk and Alexander[27] found a definite tendency to hyperacidity in asthenic children with anorexia. Campbell and Conybeare[36] found gastric hyperacidity and hypertonia associated in the stomach high in position, and gastric hypoacidity and hypotonia in the stomach low in position. Conran[33] reported a tendency to both hyper- and hypo-acidity in cases of gastroptosis.

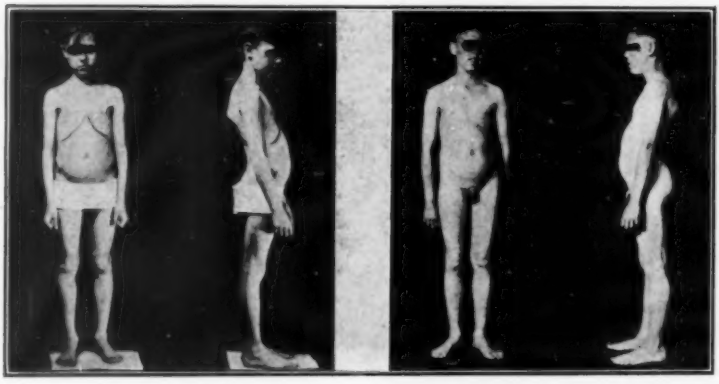


Fig. 13.—Case 5.

Fig. 14.—Case 5.

The question of the interrelationship of gastric acidity and evacuation time has been the subject of considerable controversy. Clinically it is commonly believed that hyperacidity and comparatively slow gastric emptying time and that anacidity and rapid emptying time are associated. The term "gastrogenous diarrhea" which has arisen in connection with achylia gastrica has been disputed. As pointed out by Marks[52] the theory of the "acid control" of the pylorus has had its ardent proponents and opponents. The work of Marks[52] and Smielnikoff and Gredig[53] lends support to the theory. The latter authors have made the interesting observation that only when the duodenal content is under pressure does its reaction influence the emptying time of the stomach. Kleeman[54] quotes other authors as having found alkaline duodenal content to delay pyloric closing and acid duodenal content to increase the pyloric reflex with consequent delay in emptying of the stomach. He found definite delay in emptying of the stomach roentgenologically on addition of HCl to a test meal and reports similar find-

ings by von Tabora and Dietlen. Egan[55] studied cases of anacidity roentgenologically and found the emptying time normal in most cases. In a small number he found it remarkably rapid. It must be remembered that since the advent of the histamine test of gastric secretion it has been learned that the incidence of achylia is much less than was formerly thought.

In addition to the interest anatomically and physiologically, so-called visceroptosis is frequently of great interest clinically. Symptoms may be entirely lacking. Thus Einhorn[42] remarks "persons may feel and look perfectly well and still have this abnormal condition." He thinks that symptoms once having made their appearance do not disappear readily. Conran[33] called attention to the importance of an exciting cause in the production of symptoms and to the fact that persons with gastroptosis are often restored to health without x-ray evidence of change in the gastroptosis. Osler and McCrae[56] also mention the absence of symptoms in the majority of cases unless exciting causes are present. They state "symptoms may date from a knowledge of the existence of the condition." Individual symptoms ascribed to enteroptosis are too multitudinous for enumeration. They may be dyspeptic, "neurasthenic" or circulatory. According to Fitts[37] almost all symptoms can be explained on the basis of Wagoner's experiments, increase in the negative intraabdominal pressure, as it is found in enteroptosis, giving rise to splanchnic engorgement and in some cases consequent far-reaching deleterious effect, because of disturbance of the general circulation. Since enteroptosis is apparently progressive with age, it would be expected that children be relatively free from symptoms. However, Kerley[47] and Sauer, Minsk and Alexander[27] report frequent occurrence of symptoms at least in older children.

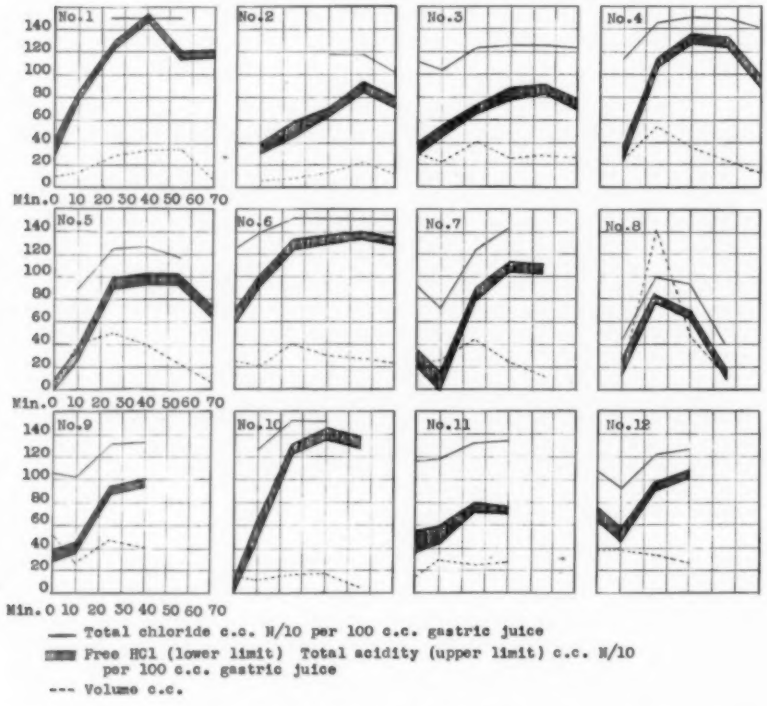
EXPERIMENTAL

Comparative studies regarding gastric position, form, secretion, motility and gastrointestinal emptying rate were carried out on twelve children of various body build. Also because of the possible relationship between mental make-up or personality and body type and gastrointestinal function, as many as possible of the subjects were examined by Dr. Senior (psychiatrist). In the study of the body type, the children were photographed and in addition teleoroentgenograms were made of their chests. Fractional gastric analyses were carried out by the histamine method described in a previous publication.[57] Motility of the empty stomach was studied by the balloon method also previously described.[58] By this method a graphic tracing of gastric motor activity is procured. Gastrointestinal emptying rate was determined roentgenologically.

The children were given a test breakfast consisting of barium sulphate 45 grams and 90 grams each of cooked cereal, milk and water with

sugar (about 8 grams) for palatability, at about 7 A.M. (While the contention of Alvarez and Friedländer[59] that because of the indigestible nature and bulk of barium, unusual and abnormal conditions of motility may be elicited is no doubt valid regarding normal evacuation time, it is probably less so regarding purposes of comparison.) After taking the test meal the children were either sitting up in bed or "up and about" to avoid variations in gastric evacuation time alleged to result from variations in position (Marx,[60] Newell,[61] and De Buys and Henriques[62]). All food and water were withheld until the stomach was empty, after which time the subjects were permitted to resume their regular diet.

Chart I - Gastric Secretory Response to Histamine Stimulation



The first roentgenographic and roentgenoscopic observations were made as far as possible three hours after the ingestion of the meal, and repeated observations were made at varying intervals until the gastrointestinal tract was entirely free of the barium. Following this, a second barium meal was given and teleoroentgenograms were made to determine the position and form of the stomach.

The average emptying time of the stomach was five and one-third hours; the shortest three hours, the longest eight hours.

The emptying time for the small intestine varied from eight to ten hours, with an average time of eight and three-quarter hours.

The average time for complete elimination of the barium from the tract averaged approximately fifty-four hours, varying from fifty to seventy-two hours.

TABLE I

NO.	AGE YEARS	HEIGHT INCHES	WEIGHT POUNDS	THEORETICAL WT.	DEVIATION FROM THEORETICAL WT.	CLINICAL STATUS	MENTAL AND EMOTIONAL STATUS
1	10	50	58	59	−2%	Occasional abdominal pain (cause undetermined) dietary indiscretion?	
2	11	56	70	78	−10%	Calcifying hilum tbc. Chronic uveitis. Anorexia nervosa	Active and talkative. Fears physical inferiority. Maladjustment (lack of security at home)
3	12	61	105	100	+5%	Convalescent acute nephritis	Superior intelligence. Apprehensive. Worrisome. Easily discouraged
4	12		101			Convalescent subchronic nephritis. Maxillary sinusitis	
5	11	52	55	73	−25%	Recurrent attacks of headache and vomiting. Migraine?	Mentally normal. Socially and emotionally immature; feeling of inferiority. Jealous and irritable
6	11	56	70	77	−9%	Compensated rheumatic heart disease. Chorioiditis, myopia	Active, cheerful, mischievous. Retarded at school
7	14	64	101	117	−14%	Functional (?) heart disturbance	Introvertive, egocentric, and selfish. Lacks physical stamina. I. Q. high average
8	10	53	55	68	−19%	Anorexia nervosa	Superior intelligence; lack of self-reliance; easily discouraged; only child; sensitive
9	15	68	111	135	−18%	Ready fatigability Frequent colds	
10	11	57	75	82	−19%	Sciatica (mild) ? Pleural tag left lung apex	Superior intelligence; emotionally normal
11	11	54	65	71	−18%	Hemangioma of thigh. Visual defect	
12	11	55	62	74	−16%	Anorexia. Post-tonsillectomy convalescent	

In one-half of the cases the appendix was visualized, the earliest recorded time was three hours the longest being twenty-seven hours.

In all cases the lowest point on the greater curvature of the stomach was below a line connecting the iliac crests, and varied from 0.5 to 8.5 centimeters.

TABLE II

SUMMARY OF ROENTGENOGRAPHIC AND ROENTGENOSCOPIC FINDINGS

CASE NO.	AGE	SEX	STOMACH EMPTY	SMALL INTESTINE EMPTY	APPENDIX SEEN	COLON EMPTY	RELATIONSHIP OF LOWEST POINT ON GREATER CURVATURE TO LINE CONNECTING ILIAC CRESTS
			HR.	HR.	HR.	HR.	
I	10	F.	6	8½		50	4.5 cm. below
II	11	F.	4½	10		52	0.5 cm. below
III	11	F.	5	9	27	51	1.5 cm. below
IV	12	F.	5	9		57	1.5 cm. below
V	12	M.	5	9		52	6.0 cm. below
VI	8	M.	8	8*		51	3.5 cm. below
VII	14	F.	5	9½	27	51	8.5 cm. below
VIII	10	F.	4½	9½	3	51	4.5 cm. below
IX	14	F.	3	8		72	9.5 cm. below
X	11	F.	5	9	5	51	6.0 cm. below
XI	11	F.	5	9	3	55	1.0 cm. below
XII	11	F.	8	8	27	52	1.5 cm. below

*Empty except for traces.

DISCUSSION OF RESULTS

The results of the study are presented objectively as far as possible. In determining the sequence of the cases (which are numbered according to build, from broad to narrow) visual evaluation was supplemented by a simple ratio of height to width at the shoulders measured as nearly as possible from the photographs.

While Mills' statement that, "incidentally it is curious that one cannot sum up all the physical proportions without a photograph" is, no doubt, entirely warranted, it seems that the state of nutrition is somewhat exaggerated by a photograph. The importance of consideration of nutrition in type determination subjectively is illustrated by Figs. 25 and 26 in which case (Case 5) a weight gain of 19 pounds in 13 months effected a decided change in appearance. As is evident from Table I and from the photographs, undernutrition although not limited to the slender type is more prevalent in this class.

Other factors to be considered in reviewing the photographs are posture and the epigastric angle. The prevalence of poor posture in the broad and slender and in the well nourished and poorly nourished alike is striking. The series of cases is obviously too small to warrant an attempt to associate different types of faulty posture with difference in body build. Although the width of the epigastric angle does not conform strictly to body build it may be said that a wide epigastric

angle is predominant in the broad type and that a narrow angle is the common finding in the narrow type.

A review of the sketches (Figs. 13 to 24) indicates that the shape of the chest does not correspond strictly to body build or to the width of the epigastric angle or to the form and position of the stomach. Again, the smallness of the number of cases interdicts definite con-

Fig. 15

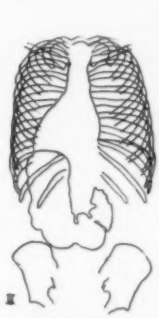


Fig. 16

Fig. 17

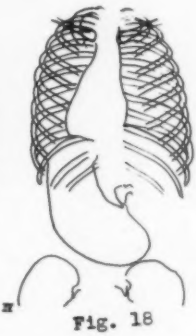


Fig. 18

Fig. 19

Fig. 20

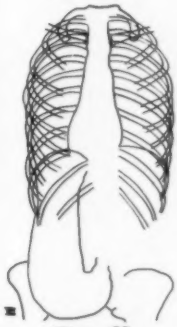


Fig. 21

Fig. 22

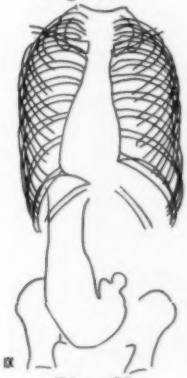


Fig. 23

Fig. 24

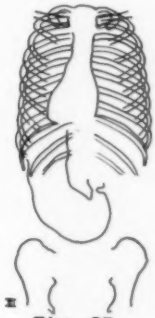


Fig. 25

Fig. 26

clusions. Further, had even more slender subjects been available for study a greater conformity might have been observed.

No definite relation seems to exist between gastric secretory function, body build, form and position of the stomach.

Fig. 27—Case 3.

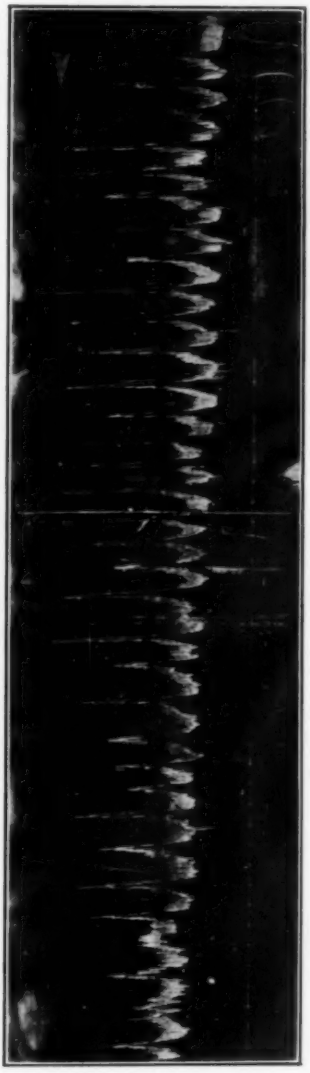


Fig. 28—Case 7.

Fig. 29—Case 11.

Fig. 30.

As has been pointed out previously the comparative value of results of work concerning motility of the empty stomach is limited. This opinion is shared by other authors. Thus Hardt and Joseph[63] state "the skiagraph even in the most expert hands has strict limitations." It may be said with some reserve that the motility is apparently somewhat greater in the broad type. The strongest activity was observed in case one and the weakest in case twelve. However, as is seen from the tracings in Figs. 27 and 28 similar results may be observed in different

types. The third tracing, Fig. 29, illustrates that the stomach of an individual of narrow build may manifest fairly vigorous activity and tone. Tracing four (Fig. 30) demonstrates the gastric activity of a child (daughter of a pernicious anemia subject) not included in the series who had complete achlorhydria. The motility of the filled stomach was correspondingly rapid (less than three hours). Except in extreme cases as this, gastric acidity and motility seem to bear no definite relation to each other.

Because of the known variability of gastrointestinal motility and emptying rate in the same individual (Fell[64]), dogmatism must be carefully avoided in interpreting results. Even if this precaution were unnecessary it would be impossible, as is obvious from the summary of the roentgenologic results, to correlate the findings with body build, gastric position and form, or with gastric secretion.

COMMENT

While the more or less ambiguous findings may seem to discourage on first consideration, the prospects of successful therapeutic prophylaxis in combating the development of symptoms are brightened. Various authors have stressed the importance of a nutritional state at or above par in slender children. In the cases here reported the response to a definite régime including a high caloric, high carbohydrate, high vitamin B diet and in some cases psychotherapy was very encouraging.

It is entirely possible that children with definite gastrointestinal symptoms present definitely abnormal findings. Other factors such as absorption and assimilation may be more closely associated with body build than those investigated.

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THE MENTAL GROWTH OF PREMATURELY BORN INFANTS

ARNOLD GESELL, M.D.
NEW HAVEN, CONN.

THE uterus is the normal environment of the fetus until the end of a gestation period of 40 weeks. But birth with survival may in very exceptional instances occur as early as 24 weeks and as late as 48 weeks, —an enormous range of variation in natal age amounting to six lunar months. Variation within a range of two or three months is comparatively common. Prematurity of birth constitutes an abnormal alteration of environment which might conceivably affect the developmental career of the infant.

We have investigated the "mental" aspects of the problem by means of periodic examinations of the behavior status of premature infants at advancing age levels. Mental growth expresses itself in changing patterns of behavior in the field of posture, locomotion, eye-hand coordination, prehension, etc. With the aid of normative methods and by means of systematic cinema records, the developmental progress of behavior patterning in selected cases was objectively studied. The general findings will be briefly indicated below.* First, however, a word may be said concerning the influence of prematurity on physical growth.

Scammon has reported an interesting investigation which bears directly on the problem. It is a study "On the Weight Increments of Premature Infants as Compared with Those of Foetuses of the Same Gestation Age and Those of Full-Term Children."[1] His results show that "premature children after a short period of retarded growth incident to the adjustment to the extrauterine environment, tend to regain the fetal rate of growth and to follow this course of growth until some time in the latter part of the first year, when the rates of fetal and post-natal growth approximate one another. In other words, the growth tendency of prematures is in general that of fetuses of the same size and age rather than that of full-term children."

Does prematurity have any radical effect upon the character and the course of mental growth? The question is one which arises frequently in the minds of parents, and is of medical importance. But there can be no simple, general answer. Prematurity of birth takes place under such a diversified array of conditions, that at the one extreme there is the certainty of permanent defect or of early death; and at the other

From The Clinic of Child Development. The School of Medicine, Yale University.

*This paper, in slightly modified form, was first reported in Part IV, *Appraisement of the Child*. Report of the White House Conference on Child Health and Protection. Section I. Medical Service. Committee on Growth and Development. New York: Century Co. 1932.

See also the author's *Infancy and Human Growth*. New York: Macmillan. 1928. Pp. 299-333.

extreme, the full assurance of ultimately normal maturity. The developmental fate of the prematurely born infant is always an individual matter, depending upon the severity of the complications produced by the prematurity and on his primary growth potentialities. There is always the logical danger that we shall ascribe to prematurity consequences which arise out of more fundamental or purely associated factors.

Since the developmental status of each case of prematurity requires individual, clinical appraisal, it is well to rephrase our question and inquire whether prematurity *as such* alters the ordinary course of mental growth. At the Clinic of Child Development we have made detailed individual studies of several cases of prematurity by means of a series of developmental examinations (and cinema records) with this question in mind. The development of two children without evidence of birth injury was investigated over a period of two years. Both children in early infancy were seriously underweight, and estimated on the basis of their behavior capacities alone, would have been diagnosed as mentally retarded or defective. For example, one child at the age of five months resembled in behavior equipment a child of three months, a serious degree of retardation under ordinary circumstances. But making due allowance for the two months of prematurity, the behavior picture was relatively normal. The detailed study of individual cases of uncomplicated prematurity strongly suggests that the general course of development is not markedly accelerated or retarded by mere precocity of birth. The central nervous system, unless it is actually impaired, tends to mature in accordance with inherent determiners, so that the cycle of behavior growth is not greatly altered by the birth displacement.

Similar factors of safety and stability seem to operate when the infant is postmaturely born, for in his behavior equipment he is advanced even though birth is postponed. There is a stable substrate of maturation, strongly entrenched in the nervous system, which tends to keep the underweight, the preterm and the postterm infant close to his normal maturity levels in the field of behavior. Accordingly monozygotic twin infants, whether born prematurely or not, whether alike or much unlike in weight, tend to display similar behavior patterns. Biologically age must be reckoned from conception rather than from birth, and when so reckoned it proves to be a fundamental factor in determining behavior level.

This principle of stable maturation is of importance in any critical consideration of the effects of prematurity on mental growth. Ylppö has proposed the term "immature" to designate any infant weighing less than 2500 grams at birth, irrespective of the length of gestation. The term suggests that the infant is not completely developed and not prepared for extrauterine life. To what extent the "immature" infant is actually immature from the standpoint of behavior development

remains a subject for careful investigation. Unfortunately it leads to confusion if the terms immature, premature, and underweight are not carefully differentiated. It has by no means been demonstrated that the fetus or infant of subnormal weight is correspondingly subnormal or immature in behavior equipment. Indeed there is evidence to the contrary. The developmental problems involved are so numerous and complicated that intensive clinical research alone can clarify the issues. Statistical conclusions may mislead unless the correlation of causative factors in each individual case is open to estimate.

Aaron Capper[2] has made a noteworthy study of the physical and mental development of 437 immature (including 72 per cent premature) children. His general conclusions are depressing. "The fate of immature children is not enviable; almost one-half of them die during the first year of life. Of those that remain alive, the majority are physically, as well as mentally, underdeveloped. Some of them show a late mental development; others show a condition of psychic infantilism, if the term may be used in its nonspecific sense; while still others show permanent and severe mental diseases. While they are passed in review, one is surprised at the variety and amount of abnormality encountered, almost a regular 'pathologic museum.' In brief, the immature infant becomes the backward school child, and is a potential psychopathic or neuropathic patient and even a potential candidate for the home for imbeciles and idiots."

The general validity of Capper's conclusions can be assessed only after a critical examination of the factors of selection which determined his cases, the complicating social and medical factors in addition to immaturity, and the nature of the data on which the estimates of mental inferiority were made.

Maria Comberg[3] has made a study of the fate of 212 premature infants, on the average 53 for each of 4 years, and 27 pairs of twins, all weighing less than 2500 grams at birth. Her general conclusions are at variance with those of Capper and in abstract are as follows: "Neuropathic irritability which, like cerebral hemorrhage, appears to be a sign of special immaturity, is found frequently in children at the ages of from three to seven who were born prematurely and who showed cerebral symptoms at an early age. Any connection between cerebral symptoms in the first weeks and later impairment of intelligence is not observed in these children, whose mentality is of the highest type in almost every particular. The age at which they learn to walk and to speak is more a lack of tone and a delayed development rather than a manifest and lasting mental injury. . . . The prematurity itself remains as the chief cause for the peculiar development of the children. . . . Physical and mental injuries which remain throughout life as a result of prematurity are not observed."

The mental development of the premature was especially investigated in a study by George J. Mohr and Phyllis Bartelme.[4] The subjects were prematurely born with birth weights of 2500 grams or less. The mean fetal age was 7.77 months. The study was carried out in the infant welfare clinic in Michael Reese Hospital, Chicago. The number of subjects is: 51 boys and 62 girls, white, 8 months to 7 years, with mean chronological age of 2 years 9 months. "There are 17 sets of twins and 7 surviving members of twin births in the group"; and 40 of their siblings, aged 6 months to 12 years and 5 months, with mean chronological age of 5 years and 8 months. Less than one-fourth of the premature children are Russian or Polish Jews, and over one-fourth are Anglo-Saxon; ten other nationalities comprise the remainder of the group of 113 subjects. The majority of families are of lower middle economic level.

The investigators found that "one hundred seven of the prematurely born children were classified as of average, above average, or below average intelligence, according to performance on the Gesell Developmental Schedules and the Kuhlmann-Binet test." "On the Gesell ratings, 43 per cent of the children were classified as average, 35 per cent as below average, and 22 per cent as above average."

The results of this study are in general agreement with those of Comberg and also, in a measure, with the clinical experience of Dr. J. H. Hess, as summarized in the following statement. "The majority of premature infants born after the thirty-second week into a proper environment, without birth injuries, undergo a normal mental development, progressing more slowly than the full-term infant during the first years. They average walking and talking about 6 months later and are somewhat slower in learning to coördinate, as evidenced by clumsiness and ease of falling, slight speech defects, etc. All of these are, however, usually temporary manifestations and are followed by normal progress."

The amount of actual retardation which premature infants as a group show in motor and language functions can only be determined by normative studies which take into account the interval of prematurity. Mohr and Bartelme[4] found that, "The prematurely born children do not differ from full-term children in time of beginning eruption of teeth, in onset of walking, in beginning of talking, and in learning of bladder control, if correction is made for the period of prematurity. The smaller prematurely born children are consistently a little later in these developments, but again the difference is minimized if this correction is made." A most interesting finding relates to the 28 of the 113 prematurely born children who "were cyanotic, had convulsions, or otherwise gave evidence of possible intracranial hemorrhage or central nervous system injury at birth. Twelve of these show no noteworthy deviations on present physical examination, five others show some disturbance of the reflexes,

and the remaining 11 present various findings. Three of these latter are mentally retarded. The general distribution of these 28 cases into the three groups, average, above, and below average, according to Gesell schedules, does not differ from that of the entire group."

GENERAL CONCLUSION

Present data, though scanty and sometimes contradictory, indicate that prematurity of birth in itself does not markedly distort, hasten, or retard the course of mental development, when the age of the infant is reckoned from conception. Intrinsic organic factors of maturation, as opposed to environment, are so powerful and stabilizing that the infant tends to follow his inherent cycle of behavior development independent of the placement of birth. Deviations and defects of development occur when the conditions of the prematurity cause pathologic changes in organs or tissues. Deviations, such as imperfect postural and locomotor control, are not necessarily permanent; but frequently resolve in the first two years of life.

It is even suggested that in some instances the effects of intracranial hemorrhage may be overcome, possibly by substitutive or compensatory development. Little is known about these important phenomena, and they could be fruitfully analyzed in the premature. They can be systematically investigated only by periodic behavior examinations, should more frequently be supplemented by correlated neuropathologic studies of cases which come to autopsy.

The behavior of the premature infant is not alone a subject of scientific interest from a genetic standpoint. It is a subject of medical significance with direct and indirect bearing upon problems of child protection. Too frequently prematurity is not recognized by physician or nurse, and the child's welfare suffers in consequence. When more is known about the behavior characteristics of the premature, there will be greater accuracy in diagnosing both the presence and the degree of prematurity. Refinements in the hygiene of the premature infant also will come through a better understanding of his behavior limitations and requirements.

Prematurity carries with it numerous hazards which may inflict temporary or permanent penalty; but fortunately the infant is also protected by the inherent factors of organic maturation, which make for a normal course of mental growth.

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14 DAVENPORT AVENUE.

TETANY IN YOUNG INFANTS

Case Report

Abraham S. Small, M.D.
Boston, Mass.

CONTRIBUTIONS to the literature concerning tetany are not wanting. There has been, however, a paucity in reports of very young infants showing this syndrome. One reason is that in the past and to this day the conception as gathered from many textbooks as well as from clinical teaching leads one to believe that tetany is manifest usually after the sixth month of life.

One thinks of tetany in terms of a textbook picture characterized by convulsions, inspiratory crow, carpal or pedal spasm, increased electrical irritability (Erb's phenomenon), a Chvostek sign, a Trousseau sign and a blood serum calcium below the "convulsion" level. These or most of these findings in an infant, particularly a male infant, occurring in the late winter or early spring of the year associated with or precipitated by an infection, demonstrable or not, are indeed the classical findings as have been observed by many authors.

A review of 75 cases from the Infants' Hospital records, studied at random, covering a ten-year period, showed the average age to be seven months. About half the patients ranged from two to six months. One baby had manifest tetany which began at twelve days of age.

Of these 75 cases, 53 were males and 23 females, all of whom had an associated infection or a history of infection just preceding the tetanic attack. In all but two cases, convulsions seemed to be the outstanding symptom. Seventy of the 75 cases reviewed had a serum calcium below 7 mg. per 100 c.c. blood (average 6.14 mg.). The incidence of the disease favored the late winter and early spring; thus 61 cases occurred from February to May inclusive, the peak of 18 cases occurring in May. There were no cases in July or August.

That tetany occurs before six months of age has been shown by G. F. Powers,[1] J. P. Griffith,[2] Wolff,[3] E. Klose,[4] E. Nassau,[5] and others.

The following case is reported because of its bizarre nature, because it is the youngest patient I could find reported in the literature, and also in order that possibly some knowledge may be gained as to some of the etiologic factors involved.

Baby B.—White, female.

Family History.—Father and mother in good health, about twenty-five years old. Only pregnancy. No history of constitutional diseases on either side of the family. No miscarriages.

From the Department of Pediatrics, Harvard Medical School, and the Infants' and Children's Hospital, Boston, Massachusetts.

The mother's health during pregnancy was uneventful for six and one-half months at which time a severe Vincent's angina became apparent. After several weeks of treatment, the condition improved so that repeated smears were essentially negative. Her general condition remained good except for the presence of albumin in the urine and a positive fixation of the specific gravity (Mosenthal test) which persisted for three weeks before delivery. Thus a suspicious pre-eclamptic state was considered. The non protein-nitrogen was normal (30 mg. per 100 c.c. blood). There was a slight elevation of blood pressure, but no edema, local or general. The final antepartum diagnosis was toxemia. The diet was liberal until the last two days when it was restricted to milk and crackers.

Birth History.—Baby was born after labor was induced by rupturing membranes. She showed no cyanosis, convulsions, hemorrhage (obvious), or anomalies. There was no need for resuscitation. Weight five pounds, ten ounces.

Feeding and Progress.—During the first eight days the baby seemed to do well, nursing vigorously at three-hour intervals, but getting only one-half to one ounce of breast milk at a feeding. It was necessary, therefore, to give complemental feedings of a formula consisting of whole milk (boiled) 7 ounces, water 9 ounces, dextri-maltose 3 tablespoonfuls. The total feeding of breast and bottle amounted to three and one-half ounces, fed every three hours, seven feedings in twenty-four hours. On the fourth day, the rectal temperature rose to 103° F., remaining elevated for twelve hours and gradually returning to normal on the fifth day. No explanation was given for this sudden and transitory pyrexia.

On the ninth day, the mother noticed that the baby began to show twitchings of the right hand; simultaneously there were twitchings of the other exposed parts, the face and lower extremities. On the tenth day nothing was noticed even though the condition was reported and observations made, but on the eleventh day the nurses reported tonic and clonic convulsions involving first one then another part of the body, at times being generalized, coming intermittently at six- and eight-hour intervals.

In spite of this state, the baby's desire for food remained the same. There was no vomiting, and the stools, varying from one to three daily, were good.

The twelfth day the nurses observed that the seizures became more marked, but fewer in number. The baby's color remained good and the temperature never rose above 99.6° by rectum.

On the fourteenth day after birth and five days after manifest convulsions, a lumbar puncture was done by the attending pediatrician and one cubic centimeter of bloody fluid obtained under no increase of pressure. Twitchings persisted at varying intervals for the following two days.

The physical examination at this time was as follows: Skin showed no dehydration. Fontanelle was not bulging. Eye grounds were within normal limits. There was no Macewen sign of cracked-pot resonance. Reflexes and extremities seemed normal. Chvostek, peroneal, or Trousseau's sign could not be elicited. There was no evidence of bleeding; there were no paralyses or anomalies. Heart, lungs, abdomen, ears, throat, were all negative. General physical examination otherwise was essentially negative.

A lumbar puncture (second interspace) yielded a bloody fluid which came after considerable manipulation of needle. It seemed that this was probably due to trauma.

Seven c.c. of blood were drawn from the longitudinal sinus and deposited in a sterile centrifuge tube for a subsequent calcium determination.

After a sufficient rest period the baby was given 20 c.c. of the father's whole blood into the buttocks. At this time several cubic centimeters of the father's

blood was sent to the laboratory for a Wassermann test which subsequently was reported negative.

Other laboratory determinations including white blood count and differential blood smear, platelets, bleeding and coagulation time were within normal limits, as were roentgenograms of the skull, thymus gland, lungs, and long bones. Urinalyses were repeatedly negative. Vaginal smear was negative. Throat smear for Vincent's organisms was also negative. Electrical reactions were not obtained.

On the sixteenth day fifteen grains of calcium chloride were given every three hours, six times daily, while awaiting the report of the serum calcium. Subsequently, the calcium was reported as being 5.6 mg. per 100 c.c. blood, and 6 mg. per 100 c.c. blood on the check-up.

Immediate Progress.—After about 60 grains of calcium chloride were ingested, convulsive seizures were definitely decreased in frequency and intensity. After 90 grains or six doses, there was only a rare twitching and finally cessation of twitchings. The therapy, however, was continued for two months.

COMMENT

Bernita Wolff quoted by Klose bases considerable importance on increase of irritability, and says, "Chvostek sign is pathognomonic," and does not accept a diagnosis without evidence of increased galvanic irritation. In the light of the work of Stevenson, Mitchell and Koch,[6] who found in normal newborn infants from twelve hours to twenty-one days, that a Chvostek sign occurred consistently without serologic or electrical evidences of tetany, also in view of the fact that the case herein reported as well as Powers' case not showing a Chvostek sign, make this sign of questionable importance. It certainly removes it from the category of "pathognomonic signs."

At the present time the consensus of opinion favors the view that a lowered blood calcium is the pathognomonic sign of tetany, especially if other diseases in which a low serum calcium is present are excluded.

What causes this lowering of blood calcium is obviously not clearly understood, and has been the basis for considerable discussion. That there seems to be a sufficient storage of calcium elsewhere in the body is proved by the fact that a patient with tetany and a lowered blood calcium can be cured without additional calcium being given. Thus the administration of cod liver oil,[7] and viosterol,[8] as well as ultraviolet irradiation[9, 10, 11, 12] are agents which have been used successfully. Parathormone has also been used to raise the blood calcium to normal levels.[13, 14, 15] Gamble and coworkers showed successful results with the use of acid-producing substances as hydrochloric acid, ammonium chloride, or calcium chloride.[16, 17]

There are several interesting facts brought out in this case study. First, that tetany may occur in bizarre form with only a few of the so-called conventional symptoms and signs. Secondly, the condition readily simulated birth injury although a little late in onset of symptoms.

Whether or not a relationship existed between the mother's mild toxemia or antecedent infection (Vincent's) and the baby's symptoms is speculative. It would seem likely that in view of the temperature, an infection played some part in precipitating an attack, even though the nature of the infection was not demonstrated.

CONCLUSION

A case of tetany beginning on the ninth day of life is reported.

This patient, now three years and nine months, has made normal mental and physical progress. There has been no illness except for an occasional respiratory infection. Convulsions have never recurred. (Wassermann and tuberculin reactions are negative.)

I wish to thank Doctor Bronson Crothers who saw this patient with me in consultation.

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ICTERUS NEONATORUM

A Study of the Icterus Index in Relation to the Fragility, Hemoglobin Content and Number of Red Blood Cells

Murray B. Gordon, M.D.
and
Michael C. Kemelhor, M.D.
Brooklyn, N. Y.

ANY discussion of icterus neonatorum must necessarily consider the genesis of bilirubin. The accepted opinion at present is that bilirubin is formed as an end-product from hemoglobin which is liberated upon destruction of the red blood cells. The various theories which have been advanced are concerned with the factors involved in the formation of bilirubin from hemoglobin and may be grouped under two main headings: the hepatogenous and extrahepatogenous.

According to the hepatogenous theory, the formation of bilirubin is one of the active functions of the hepatic polygonal cells, either independently or in conjunction with some other factor, such as increased erythrocytic destruction or the action of the reticuloendothelial system. Icterus develops in one of two ways: (a) the bile pigment is formed normally, passes normally through the polygonal cells but is obstructed in the bile ducts; (b) the bile may be formed normally but is unable to pass through the liver because of circulatory disturbance or damage to the polygonal cells themselves.

The extrahepatic origin of bilirubin is being stressed in recent studies. It is considered that the cells of the reticuloendothelial system, especially those of the bone marrow, spleen and the Kupffer cells of the liver are concerned with the metabolism and formation of bilirubin. The polygonal cells of the liver play no part in the formation of bilirubin, their chief function being the withdrawal of this substance from the blood and its excretion in the bile. The hematogenous theory has for its basis an increased destruction of red blood cells and the excessive formation of bilirubin in amounts above that which can be excreted by the hepatic polygonal cells. The escape of larger amounts of hemoglobin may be due to an altered state of the erythrocytes themselves or to an increased fragility.

The methods for the estimation of the amount of bilirubin in the blood which are universally employed are the Van den Bergh test[1] and the icterus index of Meulengracht.[2] The former is the most accurate

From the Pediatric Service of Israel-Zion Hospital, Brooklyn, N. Y.

available method for this determination and also serves as a means of differentiation between hyperbilirubinemia due to obstruction of the biliary passages and that resulting from excessive hemolysis or hepathic disturbance.

Comprehensive reviews of the literature on icterus neonatorum have been written recently by Van Creveld,[3] Mitchell[4] and Goldbloom and Gottlieb.[5] On the basis of a positive indirect Van den Bergh reaction in both cord and peripheral blood in the newborn, numerous observers consider icterus neonatorum to be of hematogenous origin. (Rolleston,[6] Williamson,[7] Knopfelmacher,[8] Cserna and Liebmann,[9] Zamorani,[10] Kramer,[11] Schiff and Farber,[12] Ylppö,[13] and Hirsch.[14]) The amount of bilirubin increases in the infant after birth, reaches the maximum between the first and seventh days and then subsides. The degree of jaundice parallels the amount of bilirubin.

The icterus index as originally described by Meulengracht[2] and later modified by Maue,[15] Bernheim,[16] Larrabee,[17] and Davis,[18] is a simpler and more practical but not as accurate method for bilirubin estimation. The amount of bilirubin in the blood is fairly constant for each individual under the same conditions, and in the adult is considered to be between 4 and 6 or 5 and 7 units. Clinical jaundice is not recognizable, and pigment does not pass over into the urine with an index lower than 15. Latent jaundice is a hyperbilirubinemia with a content of 8 to 14 units without any clinical evidence of jaundice in the skin, sclera or urine.

High icterus index values were found in the newborn by Goldbloom and Gottlieb[5] who conclude that icterus neonatorum is a physiologic process and that every newborn infant has jaundice irrespective of the presence or absence of its clinical visibility. Icterus was manifest in all infants studied with an index of 15 units or above. They noted a direct relationship between the value of the icterus index and the appearance of jaundice.

Closely associated with the bilirubin content are the processes going on in the red blood cells as evidenced by the number, fragility and hemoglobin content of the erythrocytes. This has been studied recently by Goldbloom and Gottlieb.

The present report is a study of this relationship in icterus neonatorum.

SCOPE OF STUDY

Determination of erythrocyte count, hemoglobin, icterus index and clinical jaundice were made on a group of 30 full-term, healthy newborn infants in the Nursery of the Maternity Ward of the Israel-Zion Hospital, ranging in age from two to ten days. Five successive readings were made on the second, fourth, sixth, eighth and tenth days on

each of these infants during its stay in the hospital. Fragility tests were performed upon the second and tenth days on 14 of these.

METHODS

The blood for examination was obtained by puncture of the external jugular vein. The icterus index determinations were made by a comparison of diluted serum 1:4, with a standard 1:10,000 potassium bichromate solution in accordance with Bernheim's modification of the Meulengracht test.[16] Fragility tests were carried out with the use of graded saline solutions in 15 concentrations. Erythrocytes were counted in the usual manner with standardized pipettes. The Sahli method was employed for hemoglobin determination with standardized tubes and pipettes. Clinical jaundice was determined by yellowish discoloration of the skin, sclera and mucous membranes of the body, on a more or less arbitrary scale of 0, 1 plus, 2 plus, 3 plus and 4 plus. This grading is of course open to criticism as it is based upon personal equation, but it is the most practical method for clinical application.

Davis[18] points out that there are three sources of error in the determination of the icterus index: (1) hemolysis, (2) lipemia, and (3) carotinemia. We noted early in the study that there was a tendency to hemolysis, and to overcome this, all test tubes, needles and syringes were scrupulously cleaned and dried. As a large degree of hemolysis still took place, it was decided to use only new glassware which had previously been soaked in distilled water for forty-eight hours. This last plan proved successful. All blood collected was immediately centrifuged and the serum separated. The second source of error was overcome to a great degree by drawing the blood before the 10 A.M. nursing or feeding and the third by the fact that all the infants were obtaining either mother's or cow's milk. All determinations were made within twenty-four hours.

RESULTS

Icterus Index.—The icterus index during the first ten days shows higher values than at any other period of life under normal conditions. A normal adult index of 4 to 6 units was not obtained in any infant in this series. The lowest individual figure is 7 on the sixth day in an infant whose index ranges from 9 to 12 on the other days, and the highest is 60 in a child whose index on the other days ranges from 27 to 48 units.

The trend of the index is to rise and then fall as shown by the average figures of 21 units for the second day, 27 for the fourth day, 28 for the sixth day, 25 for the eighth day and 21 for the tenth day. In studying the icterus index of these respective days in each individual infant, we note that in those with manifest jaundice, the figures on the tenth day are above the initial values in 11 instances and below these in 10. Of the latter there is the usual rise and subsequent fall in 8 and a continuous fall to below the initial values in 2. A rise followed by a fall to the original figures is noted in 4 instances. The index curve in infants without discernible jaundice shows a range of from 7 to 17 units with only slight deviations from the initial figures.

Goldbloom and Gottlieb,[5] on the basis of determinations made by the Davis method on peripheral blood, report values of 7 to 28 units at

TABLE I

COMPLETE DATA OF STUDY

NO.	AGE IN DAYS	RED BLOOD CELLS	HEMOGLOBIN PERCENTAGE	CLINICAL JAUNDICE	ICTERUS INDEX	FRAGILITY TEST
1.	2	5,190,000	112	0	13	
	4	4,890,000	92	0	12	
	6	4,090,000	90	0	16	
	8	4,220,000	90	0	13	
	10	4,180,000	88	0	13	
2.	2	5,070,000	92	0	13	
	4	4,210,000	90	0	15	
	6	4,020,000	96	0	13	
	8	3,720,000	96	0	15	
	10	4,320,000	94	0	12	
3.	2	6,410,000	104	1 plus	23	
	4	6,190,000	102	1 plus	22	
	6	5,980,000	98	2 plus	30	
	8	4,970,000	98	2 plus	28	
	10	5,350,000	98	1 plus	20	
4.	2	6,280,000	108	0	14	
	4	4,850,000	92	3 plus	30	
	6	5,300,000	98	3 plus	32	
	8	5,460,000	96	2 plus	26	
	10	5,100,000	96	2 plus	24	
5.	2	6,110,000	102	1 plus	18	
	4	5,550,000	98	4 plus	45	
	6	5,300,000	96	4 plus	52	
	8	5,410,000	94	3 plus	40	
	10	5,210,000	94	3 plus	36	
6.	2	5,900,000	104	1 plus	20	
	4	5,260,000	100	2 plus	32	
	6	4,790,000	98	2 plus	32	
	8	4,570,000	90	3 plus	48	
	10	4,600,000	90	2 plus	34	
7.	2	5,080,000	106	1 plus	19	
	4	5,860,000	98	2 plus	32	
	6	5,140,000	94	3 plus	48	
	8	4,850,000	92	2 plus	28	
	10	4,920,000	92	2 plus	24	
8.	2	5,490,000	108	0	12	
	4	5,750,000	106	0	16	
	6	5,220,000	96	0	12	
	8	5,170,000	92	0	17	
	10	4,490,000	92	0	16	
9.	2	5,390,000	104	0	10	
	4	5,230,000	94	2 plus	32	
	6	4,270,000	94	1 plus	20	
	8	4,710,000	92	1 plus	19	
	10	4,560,000	90	0	18	
10.	2	5,560,000	106	1 plus	24	
	4	5,770,000	104	1 plus	29	
	6	4,690,000	98	1 plus	26	
	8	4,810,000	98	0	16	
	10	4,900,000	90	0	15	
11.	2	4,580,000	94	0	10	
	4	4,120,000	92	0	12	
	6	4,140,000	92	0	7	
	8	4,530,000	82	0	10	
	10	4,600,000	84	0	9	

TABLE I—CONT'D

NO.	AGE IN DAYS	RED BLOOD CELLS	HEMOGLOBIN PERCENTAGE	CLINICAL JAUNDICE	ICTERUS INDEX	FRAGILITY TEST
12.	2	5,310,000	112	2 plus	30	
	4	5,590,000	102	2 plus	34	
	6	5,020,000	100	2 plus	30	
	8	5,120,000	102	2 plus	32	
	10	5,240,000	102	2 plus	26	
13.	2	5,900,000	104	2 plus	30	
	4	5,040,000	102	4 plus	50	
	6	5,450,000	94	3 plus	40	
	8	5,250,000	102	3 plus	34	
	10	5,630,000	100	2 plus	28	
14.	2	4,560,000	90	1 plus	24	
	4	4,180,000	90	2 plus	32	
	6	4,290,000	90	2 plus	35	
	8	4,210,000	92	2 plus	30	
	10	3,990,000	88	0	18	
15.	2	5,560,000	106	1 plus	24	
	4	5,310,000	102	2 plus	27	
	6	4,850,000	96	2 plus	23	
	8	4,900,000	98	1 plus	20	
	10	5,340,000	102	0	18	
16.	2	4,970,000	102	0	16	
	4	4,570,000	90	1 plus	20	
	6	4,200,000	86	1 plus	24	
	8	4,320,000	88	1 plus	20	
	10	4,210,000	88	0	18	
17.	2	5,310,000	104	2 plus	30	Begin .40 Complete .36
	4	5,200,000	102	2 plus	34	
	6	4,450,000	90	3 plus	42	
	8	4,500,000	90	2 plus	32	
	10	4,730,000	94	1 plus	24	Begin .40 Complete .36
18.	2	4,520,000	96	1 plus	24	Begin .48 Complete .40
	4	4,430,000	90	0	18	
	6	4,600,000	92	0	12	
	8	4,790,000	94	0	14	
	10	4,820,000	92	0	12	Begin .40 Complete .36
19.	2	5,080,000	104	2 plus	28	Begin .48 Complete .40
	4	4,980,000	92	1 plus	20	
	6	4,750,000	94	1 plus	22	
	8	4,720,000	96	0	17	
	10	4,830,000	96	0	18	Begin .40 Complete .36
20.	2	4,290,000	92	1 plus	20	Begin .48 Complete .40
	4	4,680,000	94	1 plus	23	
	6	4,520,000	90	2 plus	26	
	8	3,940,000	82	1 plus	26	
	10	4,650,000	90	1 plus	22	Begin .48 Complete .36
21.	2	5,250,000	102	1 plus	20	Begin .52 Complete .40
	4	5,120,000	98	2 plus	27	
	6	5,240,000	92	2 plus	22	
	8	4,830,000	98	0	17	
	10	4,230,000	90	1 plus	20	Begin .48 Complete .36
22.	2	6,170,000	112	1 plus	24	Begin .48 Complete .40
	4	6,220,000	108	1 plus	26	
	6	5,790,000	104	3 plus	38	
	8	5,860,000	98	2 plus	27	
	10	5,460,000	98	1 plus	24	Begin .44 Complete .40

TABLE I—CONT'D

NO.	AGE IN DAYS	RED BLOOD CELLS	HEMOGLOBIN PERCENTAGE	CLINICAL JAUNDICE	ICTERUS INDEX	FRAGILITY TEST
23.	2	5,460,000	106	1 plus	27	Begin .44 Complete .40
	4	4,320,000	86	4 plus	60	
	6	5,190,000	96	3 plus	48	
	8	4,890,000	92	3 plus	48	
	10	4,460,000	92	3 plus	35	Begin .48 Complete .40
24.	2	4,690,000	96	1 plus	27	Begin .52 Complete .44
	4	4,250,000	90	2 plus	30	
	6	4,010,000	86	1 plus	26	
	8	4,260,000	90	1 plus	20	
	10	4,390,000	90	0	17	Begin .48 Complete .40
25.	2	4,430,000	94	0	12	Begin .52 Complete .44
	4	3,650,000	88	0	11	
	2	4,240,000	94	0	11	
	8	3,940,000	90	0	10	
	10	3,890,000	92	0	14	Begin .44 Complete .36
26.	2	4,950,000	96	0	18	Begin .60 Complete .48
	4	4,720,000	94	2 plus	30	
	6	4,900,000	94	2 plus	35	
	8	4,860,000	94	1 plus	30	
	10	4,980,000	94	1 plus	28	Begin .48 Complete .40
27.	2	6,150,000	104	0	15	Begin .48 Complete .44
	4	5,250,000	98	2 plus	28	
	6	4,980,000	98	2 plus	30	
	8	4,720,000	96	1 plus	26	
	10	4,860,000	96	1 plus	27	Begin .44 Complete .40
28.	2	5,650,000	96	1 plus	24	Begin .52 Complete .44
	4	5,210,000	94	2 plus	32	
	6	4,860,000	92	2 plus	34	
	8	4,960,000	92	1 plus	30	
	10	4,890,000	94	1 plus	27	Begin .48 Complete. 40
29.	2	6,100,000	108	0	18	Begin .52 Complete .44
	4	5,660,000	102	1 plus	25	
	6	5,120,000	96	1 plus	28	
	8	5,210,000	98	1 plus	23	
	10	5,110,000	98	0	18	Begin .44 Complete .40
30.	2	5,210,000	108	1 plus	27	Begin .52 Complete .44
	4	5,080,000	106	2 plus	34	
	6	4,910,000	102	2 plus	38	
	8	4,860,000	100	2 plus	30	
	10	4,900,000	102	1 plus	28	Begin .44 Complete .40

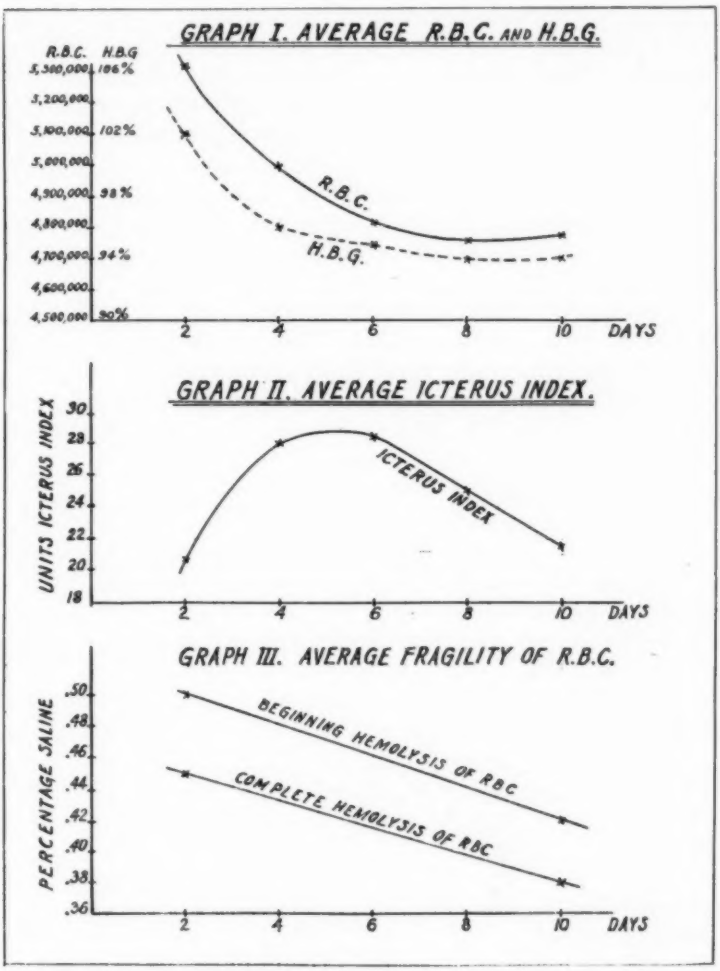
birth and of 3 to 30 units on the tenth day. They do not include figures noted in the intervening period. The values for the tenth day were higher in those infants who had developed jaundice and lower in those who did not. In the latter, there was a fall to nearly the normal in about six days.

Erythrocytes.—There is an initial polycythemia (i.e., taken on the second day) in 22 of the 30 cases distributed as follows: Above 6 million, 6; between 5 and 6 million, 16; between 4½ and 5 million, 6; and below 4½ million, 2.

The highest initial count is 6,410,000; the lowest 4,290,000. The average for the 30 infants on the second day is 5,354,000.

TABLE II

THE AVERAGE CURVES OF RED BLOOD CELL, HEMOGLOBIN, ICTERUS INDEX AND FRAGILITY WITH THEIR RELATIONSHIP TO ONE ANOTHER



The polycythemia shows a downward trend almost immediately as demonstrated by the difference between the samples taken on the second and fourth days. The fall in the total number of erythrocytes is most marked in the first six days and was found in 25 instances on the fourth day followed by further falls in 20 on the sixth day, in 14 on the eighth day and in 13 on the last day of the study.

From the sixth day on there is a tendency to recompense for the early loss by a gradual increase in the total number, but in spite of

this the final values are definitely lower than the initial ones as shown in 27 of the 30 cases. The range on the tenth day is from 3,800,000 to 5,630,000 with an average of 4,761,000.

Goldbloom and Gottlieb[5] report erythrocyte values of from 6,900,000 at birth to 4,250,000 in 180 hours (7½ days) with a subsequent rise to 4,500,000. Lucas and coworkers[19] obtained a maximum of 6,700,000, a minimum of 4,500,000 and an average of 5,511,000. Sanford[20] found a count of 5,800,000 to 4,500,000. Others have made similar observations of an initial high count and subsequent drop (Aitkin,[21] Perlin,[22] Williamson,[23] Ziegelroth[24] and Greil[25]).

Hemoglobin.—Values above 100 per cent (Sahli) are present in 21 of the 30 cases on the second day. The initial values range from 112 to 92 per cent.

The hemoglobin curve simulates that of the red blood cells, showing a fall on the subsequent examinations: in 28 cases on the fourth day, a further fall in 19 on the sixth, in 16 on the eighth and in 7 on the tenth day. Tendency to an increase is first noted on the sixth day. The final figures are lower than the initial in every infant ranging from 84 to 102 per cent, with 4 above 100.

Initial high readings at birth which rapidly fall to or below adult normal have been reported by several (Schiff,[12] Williamson,[7] Fehrsen,[26] Lucas,[19] Heimann,[27] and Takasu[28]). Sanford[20] reported a hemoglobin range of from 94 to 115 per cent. Goldbloom and Gottlieb[5] found initial values ranging from 114 to 98 with above 100 in 27 of 30. Final values at end of the week were between 94 and 98 in every case but one which was 100.

Fragility Test.—This was investigated in 14 consecutive cases, readings being made on the second and tenth days. Hemolysis beginning in dilutions of 0.48 per cent saline and over was considered as an increased fragility and a decreased resistance of the red blood cells.

An increased fragility is noted in 12 on the second day. A fall in fragility had occurred by the tenth day in 11 of the 14 cases; 8 show a fragility within normal limits (0.40 to 0.44 per cent) and 6 a slight increase (0.48 per cent).

There is an increased fragility of the erythrocytes (a decreased resistance) which diminishes and tends to approach the normal figures on the tenth day.

Goldbloom and Gottlieb[5] noted an increased fragility in 19 of the 20 cases studied by them at birth and slightly greater than normal at the end of the week in all but 2 instances.

Clinical Jaundice.—Jaundice was discernible in 25 of the 30 infants. The onset is noted on the second day in 19 instances and on the fourth day in 6. The greatest degree of jaundice is observed on the second day in 5, on the fourth day in 15 and on the sixth day in 5 infants.

There was an entire absence or 1 plus degree of jaundice in 18 on the tenth day. Berthon[29] noted that the highest point of cholemia in her series was on the third to fourth days.

CORRELATION BETWEEN THE VARIOUS COMPONENTS OF THE STUDY

There is a definite relationship between the icterus index values and the number of red blood cells in the first six days. There is a simultaneous rise in the index and a fall in the erythrocytes in 20 instances on the second to the fourth days and in 12 on the fourth to the sixth days. This relationship is less apparent in the latter part of the week, being found in only 4 instances on the eighth day and in 3 on the tenth. The tendency of the icterus index is to fall after the sixth day irrespective of the rise or fall of the red blood cells.

The hemoglobin values assume the same curve as the erythrocytes but with not as great variations.

There seems to be a definite relationship in trend between the resistance of the red blood cells and the bilirubin content as shown by the coincidental occurrence of the highest point of fragility and the initial hyperbilirubinemia with a subsequent drop in both fragility and icterus index values. Every one of the infants in this series showed a concomitant high index and an increased fragility, but there seems to be no further relation in variations in individual cases. That is, high icterus index values are not always accompanied by high fragility figures or vice versa.

There is a direct relationship between the value of the icterus index and the intensity of clinical jaundice, as demonstrated by the following comparison of the degree of discoloration and the average index values: 0 (no clinical jaundice), 14 units; 1 plus jaundice, 21 units; 2 plus jaundice, 31 units; 3 plus jaundice, 42 units and 4 plus jaundice, 51 units.

Clinical jaundice was not noted until the icterus index reached 18. This was the lowest figure at which clinical jaundice was discernible and also the maximum at which no clinical manifestation was present. The point reached in our series is 3 units above that reported by Goldbloom and Gottlieb.[5]

Manifest jaundice is most intense during the first six days, at a time when there is the greatest loss of erythrocytes and drop in hemoglobin, increased fragility and highest icterus index.

DIFFERENCES BETWEEN JAUNDICED AND NONJAUNDICED INFANTS

The icterus index values in the infants who never developed jaundice are constantly at a level which is the lowest in the series with a range of from 7 to 17 units. Another infant with a 1 plus degree of jaundice on the second day had an index of 24 but with the disappearance of jaundice on the next day, the index dropped to 18, 12, 14 and 12 units on subsequent examinations.

The hemoglobin figures in the nonjaundiced infants are the lowest in the series, ranging from 92 to 82 per cent in 3 cases and from 112 to 88 per cent in 2 others. There seems to be a more intimate relation between the hemoglobin content and the erythrocyte values than that between hemoglobin and jaundice as the higher hemoglobin figures are found in infants with counts above 5 million, irrespective of the degree of discoloration of the skin.

The red blood cell count in nonjaundiced infants does not show any pronounced variations from the general trend even though there seems to be a tendency toward the lower range. Of the 5 cases, 3 had initial values of above 5 million cells. Lucas[19] did not observe any difference in the red blood cell count between the jaundiced and nonjaundiced infants.

SUMMARY AND CONCLUSIONS

A study of the icterus index in relation to the number, hemoglobin content and fragility of the red blood cells in the peripheral blood of 30 newborn infants shows the following:

1. The icterus index during the first ten days of life shows higher values than at any other period under normal conditions. There is a rise and then a fall, the peak being reached on the sixth day.

2. The red blood cells show an initial polycythemia with a subsequent continuous drop in the first six days which is followed by an upward trend. The figures on the tenth day are below those of the second.

3. The hemoglobin content parallels the red blood cell count in both initial values and subsequent fall.

4. There is an initial increased fragility of the erythrocytes to saline which diminishes and tends to approach normal figures on the tenth day.

5. Manifest jaundice was present in 25 of 30 infants. The greatest degree of jaundice was observed in the first six days. There is a direct relationship between the degree of clinical jaundice and the icterus index values. Every newborn infant has jaundice, either latent or manifest.

6. A definite relationship exists between the icterus index and the values of the erythrocytes and hemoglobin. The index rises and the other two components fall in the first six days, but the index falls in the latter part of the week irrespective of a rise or fall in the other two elements.

7. Manifest jaundice is most intense at the time of greatest loss of erythrocytes and hemoglobin content, of increased fragility and of highest icterus index.

8. All of these conditions point to the hemolytic origin of icterus neonatorum.

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MENINGITIS IN INFANTS AND CHILDREN WITH SPECIAL REFERENCE TO AGE-INCIDENCE AND BACTERIOLOGIC DIAGNOSIS

LeRoy D. Fothergill, M.D.
AND
Lewis K. Sweet, M.D.
Boston

THE presentation of the present study has been prompted by the knowledge that certain types of meningitis are rarely seen by general practitioners or by neurologists and other specialists who confine their work largely to adults. This is particularly true of influenzal meningitis which is very rarely seen in older children and adults. For this reason it was thought profitable to review the cases of meningitis that have been seen in this clinic during the past twelve years and present certain statistical data that are of general interest.

In this communication a discussion of the clinical and bacteriologic examination of the spinal fluid in the various types of meningitis is presented. Summaries of a few cases having unusual types of meningitis are appended.

Since it would unnecessarily lengthen this paper, the authors have purposely avoided presenting a review or discussion of the literature on the various types of meningitis. It is felt that it would not be too pedantic to confine ourselves to a discussion of the cases that have been seen in this clinic during the past twelve years.

Children are admitted to this clinic from birth to twelve years of age. This study is, therefore, confined to children between these ages. During the past twelve years there have been 705 cases of meningitis in this clinic. The various types in the order of their frequency are as follows:

Tuberculous	290 cases
Meningococcus	160 cases
Influenzal	78 cases
Hemolytic streptococcus	69 cases
Pneumococcus	69 cases
All others	39 cases
	705 cases

These figures represent the usual sporadic incidence of meningitis in this vicinity. During the twelve years comprising the period of study there was no epidemic increase of any one type. Furthermore, these figures are not influenced by a particular interest in any one type of meningitis in this clinic. The vast majority of patients have been

From the Department of Pediatrics and the Department of Bacteriology and Immunology, Harvard Medical School, and the Infants' and Children's Hospitals, Boston.

referred to the hospital without the type of meningitis having been determined previously. That these assumptions are true is indicated in Table I in which the various types are listed as they recurred year by year. Of particular note is the unusual frequency of influenzal meningitis.

The age incidence percentage of the various types (computed for each half year) is shown in Charts 1 through 5. Chart 6 is a composite chart of the age incidence of the five common types of meningitis.

TUBERCULOUS MENINGITIS

Chart 1 shows the unusual incidence of this disease during infancy and early childhood; 72.2 per cent of the cases occurred before two and one-half years of age. The peak of the incidence occurred during the first half of the second year. Only 8.6 per cent of the cases occurred during the first half year of life. The youngest patients were two months of age.

The peak of the incidence of tuberculous meningitis is considerably later in infancy than is the case in the other types. This is probably due to the slow evolution of the initial tuberculous foci following infection.

The frequency of tuberculous meningitis during infancy is probably due to several factors of which the following are most important: (1) A complete lack of immunity prior to first infection. (2) The greater frequency of exposure during this period to open tuberculosis in parents, particularly mothers.

TABLE I

THE YEARLY DISTRIBUTION OF THE FIVE COMMON TYPES OF MENINGITIS

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	TOTALS
Tuberculous	20	32	27	14	26	31	36	23	18	25	23	15	290
Meningococcus	7	8	9	9	16	6	14	21	14	21	24	11	160
Influenzal	0	4	1	7	3	7	4	8	12	11	6	15	78
Streptococcus	3	2	4	1	6	7	8	5	7	8	9	9	69
Pneumococcus	4	3	2	2	3	6	8	6	5	10	12	8	69
								Total cases					666

The clinical examination of the spinal fluid in the various types of meningitis is not necessarily elaborate and requires a minimum of equipment. Complicated chemical and serological determinations are not necessary. The following observations, when carefully done, yield a maximum of information: (1) total cell count, (2) differential cell count, (3) presence or absence of a normal amount of sugar, (4) examination of direct smears and (5) cultural study of the spinal fluid.

In tuberculous meningitis the spinal fluid is usually clear or ground glass in appearance. While the cell count may vary considerably the usual finding is 100 to 200 cells per cu. mm., of which 80 to 95 per cent are mononuclear in type. Very rarely one may see a cloudy fluid with an increase in the polymorphonuclear cells.

The determination of whether or not the sugar content is reduced is of inestimable value. There is a definite reduction in the amount of sugar in the vast majority of cases. In various filtrable virus diseases of the central nervous system such as poliomyelitis, encephalitis lethargica, mumps encephalitis, measles encephalitis, etc., the sugar content is practically always normal. In these conditions the cytology of the spinal fluid is essentially the same as that in tuberculous meningitis. Therefore, the sugar reaction is of considerable differential diagnostic value. In occasional cases of tuberculous meningitis the sugar content may be normal or only slightly reduced. This occurred in several cases in this series.

Given the above findings the diagnosis of tuberculous meningitis is made certain by demonstrating an active focus of tuberculosis elsewhere

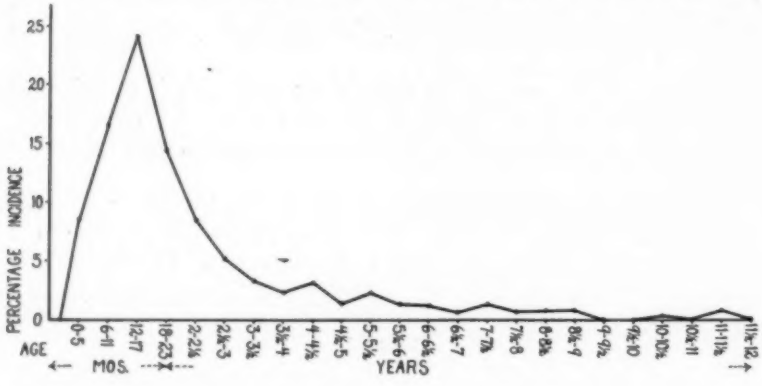

CHART 1. THE RELATION OF AGE TO INCIDENCE IN TUBERCULOUS MENINGITIS. (240 CASES)

in the body or by demonstrating acid fast bacilli in the spinal fluid. The latter method should always be persistently used. In our experience the most satisfactory smear preparation is made from the characteristic fibrin web or pellicle which forms when the spinal fluid is permitted to stand one or two hours. The tube of spinal fluid is immersed in water and the pellicle floated out with a wire needle or loop. A clean slide is brought up under the floating web. With this technic the web is well spread out on the slide. The preparation is allowed to dry, fixed by heat, and is ready for staining. The various methods of concentrating the sediment and the direct centrifugalization of the spinal fluid are less satisfactory than the pellicle technic.

Regardless of the technic, however, much time and patience and the examination of several smears may be necessary to demonstrate acid fast bacilli. Such labor is usually rewarded and is justified for the sake of an exact prognosis. Guinea pig inoculation is of no immediate value. It is of value for eventual diagnosis, particularly if necropsy is refused

and several smear examinations fail to reveal acid fast bacilli. Not infrequently bizarre forms of encephalitis are confused with tuberculous meningitis.

MENINGOCOCCUS MENINGITIS

Chart 2 shows that the peak of the incidence of meningococcus meningitis occurred during the second half of the first year (24.3 per cent). The incidence was nearly as high during the first half of the first year (21.8 per cent). Thus, 46.1 per cent or nearly half the cases occurred during the first year of life; 72.2 per cent occurred during the first two and one-half years. The youngest patient in this group was four weeks of age.

This distribution of cases illustrates the extreme susceptibility of infants to infection by the meningococcus. The probabilities of contact

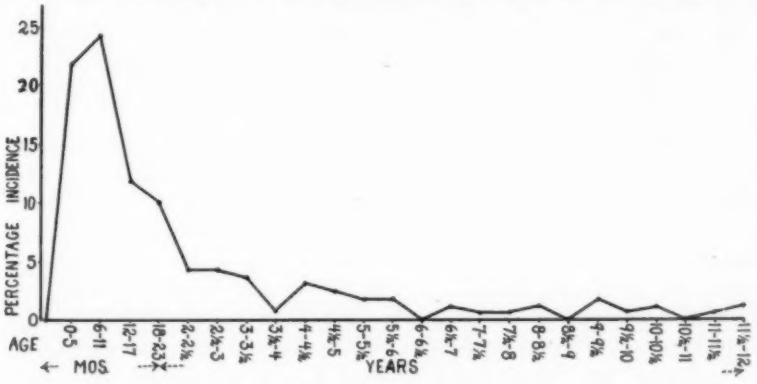

CHART 2. THE RELATION OF AGE TO INCIDENCE IN MENINGOCOCCUS MENINGITIS (160 CASES)

with a meningococcus carrier must be much less during infancy than during later periods of life. It should be emphasized again that these data represent the usual sporadic incidence of meningococcus meningitis. During an epidemic the incidence of cases in the older ages will naturally increase considerably.

In this disease the spinal fluid is usually cloudy or grossly purulent. In occasional instances it is ground glass in appearance. In rare instances, particularly in very fulminating cases, it may be clear. The total cell count thus varies considerably. There is practically always a high polymorphonuclear cell count (85 to 100 per cent). Following the first serum injection there is usually a very appreciable increase in the cell count due to the irritative effect of the serum. A gradual fall in cell count, a decrease in the percentage of polymorphonuclear cells and an increase in the percentage of mononuclear cells indicate a favorable effect from serum therapy. Frequently during the period of serum disease there is an increase in the cell count.

The sugar content in the spinal fluid is practically always reduced. If therapy is effective it gradually returns to normal.

The direct smear examination of the spinal fluid is extremely important. Unless the fluid is grossly purulent, it should be centrifugalized and smears made of the sediment. Gram's stain is preferable because it differentiates gram-positive cocci from meningococci. The meningococcus is a gram-negative, slightly biscuit-shaped diplococcus. Its morphology is quite constant, there rarely being any appreciable pleomorphism. For the purpose of indicating the immediate therapy it is not necessary to demonstrate intracellular organisms. The finding of morphologically typical organisms, regardless of whether they are intracellular or extracellular is sufficient. During the course of treatment the finding of increased numbers of intracellular organisms may be of some value in indicating the effectiveness of treatment.

It should be pointed out that in the majority of instances organisms are not numerous in smears and a diligent search of several preparations may be necessary to demonstrate them. Occasionally they are very numerous.

The spinal fluid should always be cultured. We have found chocolate agar in the form of slants to be the most satisfactory medium. At the time of the initial lumbar puncture spinal fluid is allowed to drop from the lumbar puncture needle directly onto each of two chocolate agar slants. One slant is incubated aerobically. The other is incubated under the following so-called "partial tension" technic.[1, 2] A dextrose agar slant is well seeded with B. subtilis. This tube is joined to the chocolate slant by a short piece of tightly fitting, heavy, rubber tubing. It is thought that the active growth of B. subtilis reduces the oxygen content and increases the carbon dioxide content in the system. Undoubtedly, the conservation of moisture in the system is an important factor also. The rapidity of growth and the percentage of positive results is materially increased compared with the results obtained with the second tube incubated under simple aerobic conditions.

The isolated organism should always be agglutinated with the serum being used in treatment. In the absence of agglutination a different type of serum should be sought.

INFLUENZAL MENINGITIS*

Chart 3 which gives the incidence curve for influenzal meningitis differs in certain respects from the two preceding curves, although the general trend is the same. The peak of the incidence occurred during the second half of the first year (30.7 per cent). The vast majority of the cases occurred during the first two and one-half years (84.4 per cent). There is a striking absence of the disease in later childhood.

*It is important to note that in the specific treatment of influenzal meningitis with complement and anti-influenzal serum devised by Ward and Fothergill a small group of patients have been benefited. An analysis of these results will be presented in a future communication.

There was only one patient (eleven years of age) between six and a half and twelve years. It is also of interest that the youngest patients were two months of age.

Fothergill and Wright[3] have presented some data to explain the age distribution of influenzal meningitis. The absence of the disease in the newly born is associated with the presence of a humoral antibody passively acquired from the mother by transplacental transmission. This antibody disappears between six and eight weeks of age, leaving the child entirely nonimmune during the remainder of infancy. From three years on there is gradually developed an active, acquired, natural immunity.

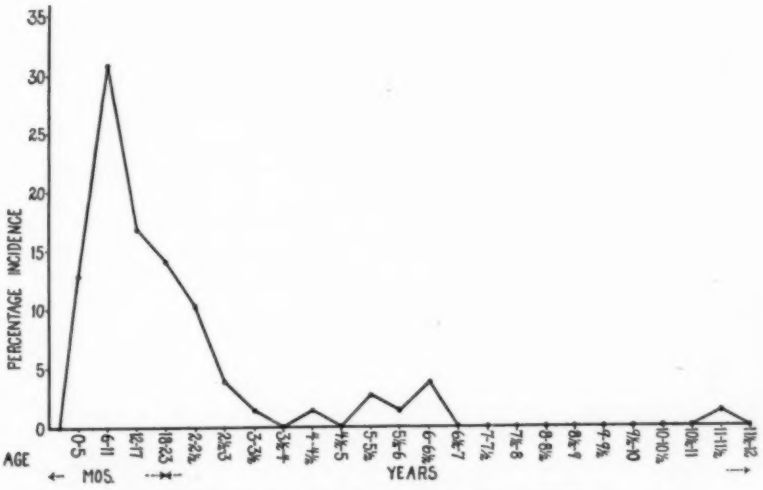

CHART 3 THE RELATION OF AGE TO INCIDENCE IN INFLUENZAL MENINGITIS (78 CASES)

In influenzal meningitis the appearance and cytology of the spinal fluid is no different from that in meningococcus meningitis. The sugar content is reduced.

The direct smear examination is of inestimable value. The characteristic findings are practically pathognomonic of the disease. In the majority of instances organisms are present in smears in large numbers. The typical finding is an extraordinarily pleomorphic gram-negative bacillus. One finds extremely minute bacilli, coccoid forms, diplococci, larger bacilli varying considerably in size, and long filamentous forms. None of the other gram-negative bacilli occasionally found in meningitis such as members of the colon group exhibit such marked pleomorphism.

Chocolate agar is the medium of choice for the influenza bacillus.

HEMOLYTIC STREPTOCOCCUS MENINGITIS

The incidence curve in this disease (Chart 4) is very different from that of the three preceding types of meningitis. The peak of the curve is displaced more toward the younger age. The highest incidence (36.2 per cent) occurred during the first six months of life. During the second six months the incidence fell to 11.6 per cent; 47.8 per cent of the cases occurred during the first year of life. After the first year the incidence throughout the remainder of childhood is more or less constant.

Nine of the sixty-nine patients were three weeks old or less. Three patients were three weeks old; three, two weeks old; and, three, one week old. The youngest patient was two days old.

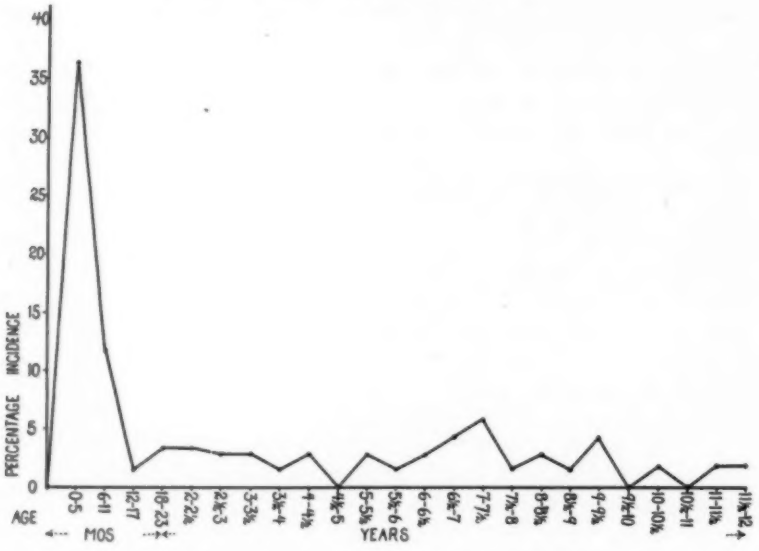

CHART 4. THE RELATION OF AGE TO INCIDENCE IN HEMOLYTIC STREPTOCOCCUS MENINGITIS. (69 CASES)

Again, the appearance and cytology of the spinal fluid is essentially the same as that in any other type of purulent meningitis. The sugar content is reduced. The typical chained, gram-positive cocci are usually fairly numerous and easily demonstrated by direct smear. When such organisms are seen in smears the spinal fluid should be immediately inoculated into broth and on blood agar plates for cultural identification. It is frequently difficult to differentiate streptococci from pneumococci by direct smear examination.

PNEUMOCOCCUS MENINGITIS

The incidence curve of pneumococcus meningitis (Chart 5) is very similar to that for hemolytic streptococcus meningitis. These two types

occurred with equal frequency; there being 69 cases of each. Here, too, the peak of the incidence occurred during early infancy; there being 33.4 per cent of the cases during the first six months. The peak of the incidence fell off rather more slowly in later infancy than was the case with the streptococcus group. Fifty-two and two-tenths per cent of the cases occurred during the first year of life and 70.4 per cent occurred during the first two years. There were four cases one week of age and one case two weeks of age. The youngest patient was one day old. Following is the rather unusual history of this case:

E. L., a white, female infant, was admitted January 20, 1929, at four hours of age because of cyanosis. The infant was delivered by cesarean section five minutes after the mother had died from advanced cancer of the breasts. The dura-

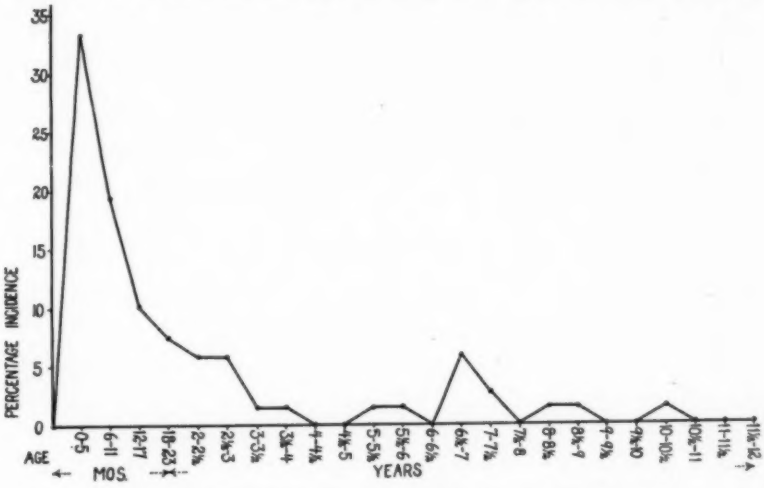

CHART 5. THE RELATION OF AGE TO INCIDENCE IN PNEUMOCOCCUS MENINGITIS (69 CASES)

tion of pregnancy was estimated at eight months. During the two weeks prior to death the mother received two to three grains of morphia daily. The birth weight was five pounds, four ounces. There was a later history obtained of mouth to mouth insufflation. Three hours after birth the infant suddenly developed cyanosis. For this reason she was admitted to the Infants' Hospital. The lungs showed a generalized dullness posteriorly, less marked over the left base. The breath sounds were diminished with a slightly bronchial quality over these areas. Roentgen-ray examination showed a diffuse clouding of the right lung. The patient was transfused twelve hours after admission because of a prolongation of the bleeding time. A blood culture was positive for the pneumococcus. During the two days in the hospital she became very cyanotic on several occasions. Twenty-four hours after admission there was an intense icterus. The patient died suddenly at forty-two hours of age. The final diagnoses confirmed by necropsy examination were: confluent pneumonia, pneumococcus septicemia, pneumococcus meningitis, icterus neonatorum and prematurity. The possibility is strongly suggested that this infant acquired an intrauterine infection.

The appearance and cytology of the spinal fluid of patients with pneumococcus meningitis is the same as that in other types of purulent meningitis. The sugar content is reduced. In direct smears gram-positive, lancet-shaped diplococci are seen. Capsules can usually be demonstrated. Such a spinal fluid should always be inoculated into broth and on blood agar plates for further identification.

It is very striking that the pneumococcus is frequently very numerous in such spinal fluids. Indeed, the turbidity of the fluid is often due to the large numbers of bacteria rather than to a high cell count. In

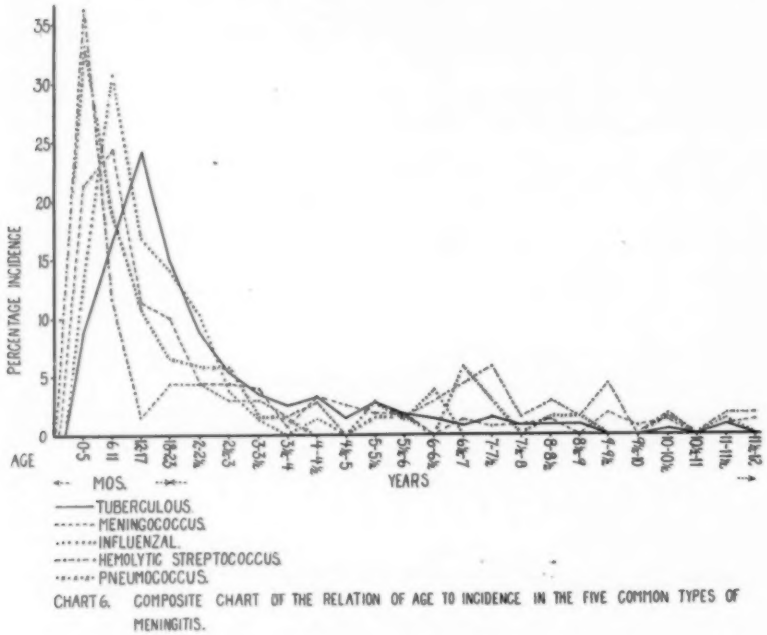

CHART 6. COMPOSITE CHART OF THE RELATION OF AGE TO INCIDENCE IN THE FIVE COMMON TYPES OF MENINGITIS.

such instances it is frequently possible, not only to confirm the diagnosis of pneumococcus, but to type the pneumococcus directly from the spinal fluid, all in a minimum of time. The fluid is centrifugalized at low speed which throws down the cells and leaves a suspension of pneumococci in the supernatant fluid. Some of this can be used for a bile solubility test to confirm the diagnosis. The remainder is used for typing which can be done very quickly by the Sabin[4] slide technic. It is frequently possible to have the diagnosis and typing finished one or two hours after the lumbar puncture. It should be emphasized that such a spinal fluid finding is not universal in pneumococcus meningitis. Occasionally a fluid will be obtained in which organisms are extremely few.

OTHER TYPES

In addition to the cases representing the five common types of meningitis there were 39 additional cases of various etiology. Fifteen of these cases were of obscure etiology. A few of these were aseptic meningitis due to some extradural lesion. There were a few cases of mixed infection and a few cases due to obscure organisms that were not identified. There was one case due to the Friedländer bacillus.

There were fifteen cases due to the staphylococcus. Three of these were Staphylococcus albus and occurred as complications in either hydrocephalus or chronic meningococcus meningitis. In each instance the infection was relatively benign and continued for a long period of time. One of the three patients recovered from the infection. The remaining twelve cases were due to the Staphylococcus aureus. In the majority of them meningitis occurred secondary to some extradural lesion such as osteomyelitis of the vertebrae or skull, fractured skull, laceration of the scalp, etc.

There were nine cases due to members of the colon group of bacilli. With the exception of one case in a child nine years and ten months of age, these cases occurred between one and five weeks of age. There were certain features about this group of nine cases that merit some comment. A bacteremia was almost universally present. Blood cultures were taken during life on seven of the nine patients. In six cases the blood culture was positive; the same organism being isolated from the blood as from the spinal fluid. In the majority of cases there was a relatively high percentage of mononuclear cells in the spinal fluid compared to other types of purulent meningitis. In one patient who lived a long time the polymorphonuclear percentage was high early in the course of the disease. However, there was a gradually increasing percentage of mononuclear cells late in the disease, even though cultures of the spinal fluid continued to be positive. In those patients in whom the course of the disease was long, the percentage of mononuclear cells in the spinal fluid was particularly high.

The course of the disease was exceptionally long and relatively benign in four of the nine cases. In such instances the spinal fluid would continue to show positive cultures, however. Death was usually associated with some complication, particularly a gradually developing hydrocephalus.

RÉSUMÉ

This survey of the various etiologic types of meningitis in infants and young children strikingly illustrates the susceptibility of infants to infection. This susceptibility during infancy no doubt plays a more significant rôle in the age distribution of meningitis than any other epidemiologic factor. It is also of interest to note that there is a slight but definite increase in the incidence of influenzal, streptococcus, and pneumococcus meningitis between the ages of five and seven years.

These three organisms are primarily associated with respiratory infections. It is quite possible that the increased incidence at this age may be associated with the increased number of exposures to carriers of these organisms occasioned by entering school.

Meningitis in newly born infants, i.e., those under four weeks of age, is surprisingly restricted in etiology to three groups of organisms; namely, the hemolytic streptococci, the pneumococci, and colon bacilli. Of these, infection by the colon group of bacilli is less frequent than by the two gram-positive cocci.

With respect to the examination of the spinal fluid the authors wish to emphasize that the findings that have been discussed above are the more common ones and that one may get frequent variations from these.

A definite routine for the combined diagnosis and early treatment of patients with purulent meningitis is desirable. All patients with a cloudy spinal fluid are given an intrathecal injection of antimeningococcus serum at the time of the first lumbar puncture. The spinal fluid is then examined to determine the infecting organism. In this manner patients with meningococcus meningitis are given the advantage of early treatment pending an exact etiologic diagnosis.

We wish to emphasize the value of employing chocolate agar as a routine culture medium in all cases of purulent meningitis. The hemolytic streptococcus and pneumococcus grow well on it. As has been pointed out above it is an excellent medium for culturing the meningococcus. The influenza bacillus grows rapidly and luxuriantly on this medium. It will not grow on ascitic agar and other media commonly employed for culturing the meningococcus. As can be seen from the data in the early part of this paper, influenzal meningitis is common in infancy and early childhood. During nonepidemic times it occurs almost half as frequently as meningococcus meningitis. Thus, by employing chocolate agar as a routine medium the diagnosis can be made quickly and surely, whereas, if such media as ascitic agar are routinely employed the diagnosis of influenzal meningitis may occasionally not be made and the patient considered an unsuccessfully treated case of meningococcus meningitis.

The sugar content of the spinal fluid is always a useful determination. It is practically always reduced in purulent meningitis of all types. Its importance lies in the fact that it is usually normal in amount in so-called sterile meningitis due to some extradural lesion. Frequently the spinal fluid in such patients will have an appearance and cytology identical with that in purulent meningitis. In such instances the sugar content may be of great help in differential diagnosis.

CASE SUMMARIES

The following cases seem of sufficient interest to report them individually.

CASE 1.—W. S. This four-week-old male infant entered the hospital December 24, 1921, because of persistent vomiting and diarrhea since the third day of life. The infant had been breast fed and had had no known contact with persons who were ill. He was poorly nourished and extremely dehydrated. The sutures and fontanelles were open but not bulging. The chest was clear. The abdomen was normal, except for a palpable liver. Under symptomatic treatment the diarrhea stopped but the vomiting persisted. A blood culture on the sixth day yielded an organism identified as the Friedländer bacillus. Lumbar puncture was done the following day and yielded a cloudy fluid under normal pressure. It contained 2,160 cells per cu. mm. of which 69 per cent were polymorphonuclear and 31 per cent were mononuclear leucocytes. Gram-negative bacilli were seen in smears which were identified culturally as Friedländer's bacillus. The patient failed rapidly and died on the eighth day after admission. Necropsy permission was not obtained.

CASE 2.—M. V. S. This one-month-old female infant was brought to the hospital September 1, 1923, because of projectile vomiting and increasing diarrhea of five days' duration. The baby had been breast fed since birth. The night before the onset of the illness the patient's mother had a chill and fever which was followed next morning by swelling and redness of her breast. On admission the patient was acutely ill and severely dehydrated. Her skin was quite inelastic, her anterior fontanelle was depressed and her temperature was 101° F. Her neck was not stiff and her heart, lungs and abdomen were negative to physical examination. She was given symptomatic treatment without benefit. She became slightly jaundiced, her skin became scleromatous and she died one week after entry.

Necropsy showed a thick, fibrinopurulent exudate over the base of the brain and covering the medulla, pons and cerebellum. It extended as a thin layer over the cerebral hemispheres, being most marked along the course of the vessels. Stained films of the pus showed large numbers of polymorphonuclear leucocytes and short, extracellular, gram-negative bacilli. These were identified on culture as B. coli. A similar organism was obtained from the blood stream and from pus which filled the right middle ear cavity. There was, however, no gross evidence of extension of the infection from the middle ear to the meninges.

CASE 3.—H. G., a five-week-old male infant, was brought to the hospital July 20, 1923, because of inability to take food and failure to gain since birth. There were no other untoward symptoms. He was an acutely ill, poorly developed and emaciated infant with a temperature of 101° F. He had a hoarse, feeble cry and loose, inelastic skin. There was a cleft palate and a severe thrush infection of the mouth. The umbilical stump was moist with a sanguino-purulent exudate. The liver was enlarged but the spleen was not palpable. On admission the fontanelle was normal, the neck was not stiff and there was no Kernig sign. The following day the patient's temperature rose to 107° F. and he developed a bulging fontanelle, a stiff neck and a bilateral Kernig sign. Lumbar puncture was done and B. coli revealed on smear and by culture. A similar organism was recovered from the blood stream on culture. The patient failed rapidly and died the day after entry.

Necropsy revealed an omphalitis with an abscess of the right umbilical artery, and a purulent meningitis involving the subarachnoid space over the whole brain. The exudate was thicker and more plentiful over the base of the brain and along the temporal lobes. The colon bacillus was isolated from the hypogastric artery, the meninges and the blood stream. There was a right otitis media from which pneumococci alone were isolated.

CASE 4.—P. C., a three-month-old male infant, was brought to the hospital July 1, 1930, because of vomiting and diarrhea since two weeks of age and retraction of the head for six weeks. He was poorly developed and nourished, with rapid Cheyne-Stokes type of respirations, a bulging anterior fontanelle, a stiff neck with

extreme opisthotonus, hyperactive reflexes with a positive Kernig sign and an elevated blood pressure. The urine contained a very slight trace of albumin and 10 to 12 white blood cells per high power field. Lumbar puncture was done on admission. The recovered fluid was turbid and xanthochromic with strongly positive globulin test and a decreased sugar content. There were 1,700 cells per cu. mm., of which 25 per cent were polymorphonuclear and 75 per cent mononuclear leucocytes. No organisms were demonstrable by direct smear. The patient was given antimeningococcus serum intrathecally every twelve hours and once daily thereafter until a correct diagnosis was established. He failed rapidly, his temperature rising to 105° F. and death occurred four days after admission. Cultures of the blood and spinal fluid yielded B. coli.

Necropsy revealed an extensive pyelonephritis, a chronic meningitis and ependymitis with a block of the foramina of Luschka and Magendie resulting in an internal hydrocephalus. There was an acute toxic reaction in other viscera associated with petechial hemorrhages throughout the body. Cultures of the blood and spinal fluid at necropsy yielded organisms identical with those recovered during life.

CASE 5.—W. T., admitted to the hospital May 29, 1929, was born by a long, difficult, noninstrumental delivery. At the age of four days he became listless and refused food. Two days later, because of a bulging fontanelle, a lumbar puncture was done and straw-colored fluid was removed. The baby's head continued to enlarge and he was admitted to the Infants' Hospital at the age of five weeks. At that time he was small but well developed and nourished with a large head, a bulging anterior fontanelle, and a stiff neck with opisthotonus. His extremities were spastic and his reflexes were hyperactive. Ventricular puncture yielded a xanthochromic fluid with a positive globulin reaction, reduced sugar and 280 cells per cu. mm. of which 80 per cent were mononuclear and 20 per cent polymorphonuclear leucocytes. Cultures of the fluid yielded an organism with the biological reactions of B. lactis aerogenes. Two blood cultures were negative. There was marked hydrocephalus with greatly dilated ventricles. In addition to meningitis, congenital syphilis was diagnosed by roentgen ray and serologic studies. The patient remained in the hospital three months, during which time his weight was stationary and his temperature was normal except for occasional slight rises to 100° F. or 101° F. His head enlarged slowly despite frequent ventricular taps. The character of the cerebrospinal fluid remained essentially unchanged. He was discharged home at the age of four months to be cared for by his local physician.

CASE 6.—J. M. Admitted October 15, 1928. This two-week-old male infant, born at term by high forceps delivery, was brought to the hospital because of failure to nurse, fever, and convulsions for three days. He was an extremely ill baby, with a temperature of 107.4° F., convulsive twitchings and a palpable liver and spleen. He had a normal fontanelle, a supple neck and normal reflexes. A lumbar puncture yielded a turbid spinal fluid with a positive globulin test, diminished sugar content and 5,350 cells per cu. mm. of which 60 per cent were polymorphonuclear and 40 per cent mononuclear leucocytes. A stained film showed numerous gram-negative bacilli which were identified on culture as B. acidi lactici. Identical organisms were isolated from the blood by culture. The patient continued to run an elevated temperature and had repeated convulsions which were only partially controlled by sedatives. His spinal fluid became increasingly purulent and he died one week after admission.

Necropsy revealed an extensive meningitis and ventriculitis with a thick, green, fluid pus filling the ventricles, the central canal of the spinal cord, and the subarachnoid spaces surrounding the spinal cord and the base of the brain. The exudate extended along the course of the vessels over the entire brain surface. There were thromboses of the superior longitudinal sinus and of the veins over the right temporal lobe of the brain.

CASE 7.—Baby F. Admitted November 2, 1931. This ten-day-old premature infant, born by cesarean section at the seventh month of gestation because of placenta previa in the mother, was admitted to the Infants' Hospital because of jaundice for one week and apathy, refusal of food and instability of temperature for three days. She weighed four pounds ten ounces, was pale, apathetic, acutely ill and had a full fontanelle. Her neck was not stiff and Kernig's sign was not present. Lumbar puncture on admission yielded a turbid fluid with a positive globulin test and reduced sugar content. It contained 1,450 cells of which 95 per cent were polymorphonuclear leucocytes. A stained film of the sediment contained many gram-negative bacilli which were thought to be one of the intestinal bacilli. Both chemical and serologic treatment were ineffective. The patient maintained a very unstable temperature for five weeks during which time her weight remained stationary. During this long course the percentage of mononuclear cells in the spinal fluid gradually increased. After the fifth week her temperature became stable, she began to gain weight and seemed greatly improved except for the development of a progressive hydrocephalus. A block between the cerebral and lumbar subarachnoid space was demonstrated at the end of the first month. In the middle of the fourteenth week, her weight then being six pounds, five ounces, the patient became feverish and developed signs of pneumonia. She failed rapidly thereafter, and died fourteen weeks after entry. The unusual feature in this infant was that for a long period of time she maintained an essentially normal temperature, gained weight, and appeared quite well despite a continual intracranial infection and a gradually increasing hydrocephalus.

Necropsy revealed, among other things, chronic meningitis, hydrocephalus with markedly dilated ventricles and flattening of the convolutions, chronic ulcerative enteritis, phagocytosis of pigment in the ileum, colon, spleen, meninges and adrenal medulla, chronic nonsuppurative interstitial nephritis, bronchopneumonia, and hematopoiesis in the spleen, liver, kidneys, adrenal medulla and thymus.

The gram-negative bacillus recovered repeatedly from the spinal fluid and by blood culture was difficult to identify positively. Because of its failure to ferment carbohydrates it was thought to be a member of the B. alkaligenes group. However, a slight yellowish pigment production, together with the absence of carbohydrate fermentation, suggested the possibility of the Flavus group of bacilli.

CASE 8.—H. M., a nine-year-ten-month-old boy, was admitted to the hospital September 2, 1931, because of fever, headache and vomiting of four days' duration. Three days before admission he had a chill followed by a rise in temperature which continued elevated. He vomited frequently, complained of severe headache and was irrational most of the time. His neck and back were very rigid and the Kernig sign was positive on both sides. A lumbar puncture yielded a turbid spinal fluid and antimeningococcus serum was given intrathecally. The spinal fluid exhibited a positive globulin test and reduced sugar content. There were 2,325 cells per cu. mm. of which 90 per cent were polymorphonuclear and 10 per cent mononuclear leucocytes. Many gram-negative bacilli were seen in direct smear. The patient failed rapidly and died the morning following admission.

The organism cultured from the spinal fluid was a nonlactose fermenting, gram-negative bacillus exhibiting the fermentation reactions of the paratyphoid B. group. However, it was not agglutinated by B. paratyphosus A, B. paratyphosus B, B. aertryeke, and B. enteritidis anti sera. It probably belonged to the heterogeneous group of intestinal bacilli previously described by one of us.[5]

CASE 9.—A. A., a ten-month-old infant, was admitted to the hospital December 21, 1928, because of an enlargement of the head of two weeks' duration. The patient had snuffles at three months of age and a blotchy, macular rash covering most of the body. The Wassermann was positive and the patient had received one injection of sulpharsphenamine one month before admission. Five months before admission the infant began to vomit and this became increasingly frequent. The

head was noted to be enlarging two weeks before admission. For the three days prior to admission the infant refused food and was feverish. The patient's head was very large. The fontanelle was bulging, the sutures spread and the eyes displaced downward. Lumbar puncture yielded a cloudy spinal fluid with positive globulin test, reduced sugar content and 65 cells per cu. mm. of which 38 per cent were polymorphonuclear and 62 per cent mononuclear leucocytes. Many gram-negative bacilli were seen in direct smears. B. coli was cultured both from the spinal fluid and blood. The temperature gradually rose and the patient died three days after admission.

Necropsy showed a subdural hematoma involving practically all the upper surface of both cerebral hemispheres. There was an extensive fibrinopurulent exudate covering the entire base of the brain and which extended along the blood vessels. This patient was reported in greater detail by Sherwood[6] in his paper on subdural hematoma.

CASE 10.—J. H., an eight-day-old white, male, premature infant, was admitted to the hospital October 5, 1927, because of vomiting. The infant was born after seven and one-half months' gestation by an easy delivery. Following birth its cry was feeble and it breathed with some difficulty. The patient was unable to nurse and had been given breast milk by gavage and medicine dropper alternately. Jaundice had been present for several days. Examination revealed a small, poorly developed and nourished premature infant who was moderately jaundiced. The fontanelle was soft and the reflexes were normal. Following admission the infant continued to vomit and ran an elevated temperature. On the fourth day convulsions and a bulging fontanelle were noted. The patient suddenly died before a lumbar puncture was done.

Necropsy revealed many patchy areas of pale, yellow-brown, purulent material over the surface of the brain. There was a great deal of greenish yellow, purulent material about the base of the brain. Smears of the material showed many gram-negative bacilli. These were identified culturally as B. acidi lactici.

SUMMARY

1. The susceptibility of infants to infection is apparent from the age distribution of the various etiologic types of meningitis. The majority of cases of each type occur during the first two years of life.

2. The frequency of the occurrence of influenzal meningitis is pointed out.

3. The characteristics of the spinal fluid are discussed for the various types of meningitis from the point of view of practical etiologic diagnosis.

4. The superiority of chocolate agar as a routine spinal fluid culture medium is emphasized.

5. Summaries of nine cases of meningitis due to various members of the colon group of bacilli are presented. In addition one case due to the Friedländer bacillus is presented.

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STUDIES IN RICKETS. VI. COMPARISON OF THE DEVELOPMENT OF RACHITIC CHILDREN WITH THAT OF CHILDREN IN WHOM RICKETS WAS PREVENTED BY ULTRAVIOLET IRRADIATION

J. Victor Greenebaum, M.D.
and
Theodore K. Selkirk, M.D.
Cincinnati, Ohio

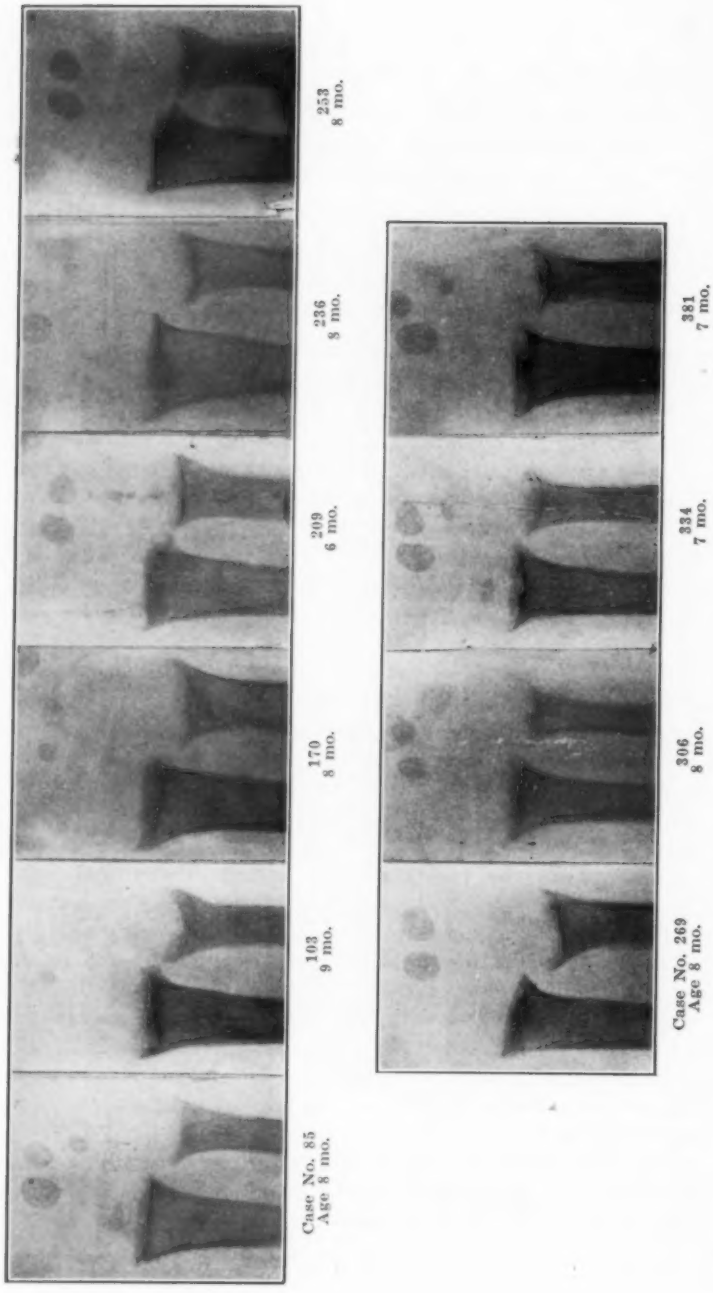
IN 1928 we reported before the Section on Pediatrics of the American Medical Association a study[1] of ultraviolet irradiation, in which we found that an exposure of eleven minutes a month, given regularly, was sufficient to protect infants against rickets. The present paper is a study of some of the children of that series at five years of age with special reference to the effects of the presence or absence of infantile rickets on their subsequent development.

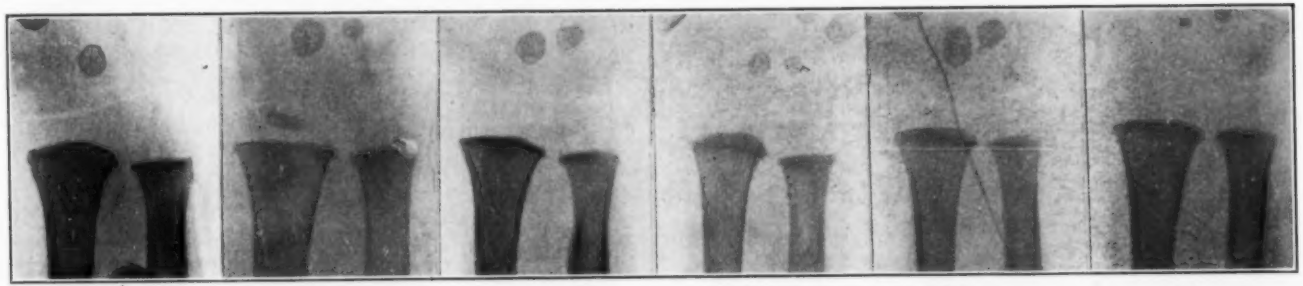
There have been comparatively few studies in recent years on this subject. Much research has been carried out on various phases of rickets during the acute and healing stages, but there are only a few studies available on what happens in later years to children who have had rickets in infancy. Of those published some, like those of Mackay and Rose[2] and Toverud and Toverud,[3] employ a method different from ours. They select, for their rachitic group, children who by reason of certain present stigmata or incidents in the past history they judge must previously have had rickets, but with whom there was no actual contact by the investigators during infancy at the time of the acute stage.

Hess and Abramson[4] employ a method similar to our own, that of observing patients by roentgenograms during infancy and again at older ages. Perhaps the reason this method of studying the later effects of infantile rickets has not been more generally employed is that the use of the roentgenogram for the observation of large series of infants is not very old. The work of Eliot,[5] which gave an impetus to this sort of study was not published until 1925 and children of subsequent studies are just now reaching school age. We were fortunate in being able to follow children of a series we had examined roentgenographically in infancy in the course of a study on the prevention of rickets by ultraviolet irradiation.

In the original study, because of irregularity of attendance at the welfare station, varying doses of ultraviolet irradiation had been given to the infants. Among those infants receiving inadequate irradiation

From the B. K. Rachford Department of Pediatrics, University of Cincinnati, College of Medicine, and the Babies' Milk Fund Association.


Case No. 85
Age 8 mo.
103
9 mo.
170
8 mo.
209
6 mo.
236
8 mo.
253
8 mo.
Case No. 269
Age 8 mo.
306
8 mo.
334
7 mo.
381
7 mo.



Case No. 16 Age 8 mo. | 78 7 mo. | 86 7 mo. | 94 7 mo. | 212 8 mo. | 216 9 mo.

Case No. 264 Age 8 mo. | 286 8 mo. | 293 8 mo. | 314 7 mo. | 345 7 mo. | 362 7 mo.

TABLE I

RICKETS GROUP

CASE NO.	BORN	SEX	MINUTES LIGHT PRIOR TO FIRST EVIDENCE OF RICKETS IN ROENTGENOGRAM	MINUTES LIGHT BETWEEN ONSET OF RICKETS AND 8 MONTHS	MINUTES LIGHT 8 MONTHS OF AGE AND LATER	AGE IN MONTHS AT LAST TREATMENT	RICKETS AT 8 MONTHS	HISTORY	PRESENT AGE	HEIGHT (INCHES)	WEIGHT (POUNDS)	POSTURE*	NUTRITION*	BONES	ABDOMEN	NUMBER CARIOUS DECIDUOUS TEETH	PERMANENT TEETH, NUMBER PRESENT	PERMANENT TEETH, NUMBER CARIOUS	DENTAL ARCH*	OCCLUSION*
85	9/13/26	M	0	0	0	—	++	Measles Pertussis Pneumonia Nasal Obstruction	5 yr. 11 mo.	43.25	40.5	F	F	Knock Knee	Umbilical Hernia	4	0	0	N	N
103	9/27/26	F	4	6	6	9	++	Measles Pertussis Chicken Pox	5 yr. 8 mo.	38.5	35.0	F	G	Normal	Normal	2	0	0	N	N
170†	8/2/26	M	0	0	124	15	++	Mumps	5 yr. 11 mo.	43.0	39.0	F	F	Pigeon Breast	Normal	4	6	0	N	N
209	1/6/27	M	0	0	58	21	++	Measles Chicken Pox Convulsions	5 yr. 6 mo.	45.0	51.0	F	G	Knock Knee	Prominent	2	5	0	N	N
236†	5/11/27	M	69	129	280	13	++	Measles Pertussis Thumb-Sucking	5 yr. 1 mo.	43.0	43.5	G	G	Pigeon Breast	Normal	2	0	0	N	N
253†	9/27/26	M	0	0	0	—	++	Measles	5 yr. 9 mo.	43.5	40.5	F	G	Normal	Normal	8	0	0	N	N
269	10/31/26	F	0	0	0	—	++	Nasal Obstruction	5 yr. 8 mo.	42.5	40.75	G	G	Normal	Normal	1	0	0	N	N
306	6/23/27	F	0	0	0	—	++	Scarlet Fever Measles Pertussis Thumb-Sucking Mouth Breather	5 yr. 0 mo.	40.5	34.0	G	F	Knock Knee	Umbilical Hernia	2 Two other deciduous teeth show enamel disease	0	0	N	N
334	7/7/27	F	32	4	0	6	++	Measles	5 yr. 0 mo.	40.5	34.5	F	G	Normal	Prominent	4	0	0	N	N
381	7/2/27	M	0	0	0	—	++	Measles Pertussis Thumb-Sucking Mouth Breather	5 yr. 1 mo.	44.75	44.5	G	G	Knock Knee	Umbilical Hernia	2	0	0	H	M

*F = Fair; G = Good; N = Normal; H = High; M = Malocclusion.

†Cases No. 170, 236 and 253 received no cod liver oil before 8 months and the rest of the children received small amounts.

TABLE II

NONRICKETS GROUP

CASE NO.	BORN	SEX	MINUTES LIGHT BEFORE 8 MONTHS OF AGE	MINUTES LIGHT THEREAFTER	AGE IN MONTHS AT LAST TREATMENT	RICKETS IN 8 MONTHS	HISTORY	PRESENT AGE	HEIGHT (INCHES)	WEIGHT (POUNDS)	POSTURE*	NUTRITION*	BONES	ABDOMEN	DECIDUOUS TEETH NUMBER CARIOUS	PERMANENT TEETH NUMBER PRESENT	PERMANENT TEETH NUMBER CARIOUS	DENTAL ARCH*	OCCLUSION*
16†	8/15/26	F	211	72	10	0	Measles Pertussis Chicken Pox Pneumonia	6 yr. 0 mo.	47.0	46.5	G	G	Normal	Normal	5	2	0	N	End to End Bite
78	12/30/26	M	276	30	11	0	Measles Pertussis	5 yr. 5 mo.	43.5	42.5	G	G	Normal	Normal	6	0	0	N	N
86	1/23/27	F	173	16	9	0	Measles Pertussis Thumb-Sucking	5 yr. 4 mo.	43.75	45.5	G	G	Normal	Prominent with Umbilical Hernia	1	2	0	N	N
94	1/22/27	F	56	0	7	0	Measles Pertussis Chicken Pox Mouth Breather	5 yr. 5 mo.	42.0	35.0	F	F	Knock Knee	Prominent	4	0	0	N	N
212	4/20/27	F	232	90	14	0	Mouth Breather	5 yr. 1 mo.	41.5	33.0	F	G	Normal	Prominent	3	0	0	N	N
216	4/25/27	F	127	28	10	0	Pertussis	5 yr. 2 mo.	43.5	42.25	G	G	Knock Knee	Umbilical Hernia	0	4	0	N	N
264	4/2/27	M	257	110	11	0	Measles Scarlet Fever	5 yr. 2 mo.	39.5	37.5	G	G	Normal	Prominent	0	0	0	N	N
286	6/23/27	M	142	52	11	0	Pertussis Nasal Obstruction	5 yr. 0 mo.	44.0	46.5	G	G	Parietal Bossing Knock Knee	Umbilical Hernia	0	0	0	N	N
293	6/17/27	F	124	86	16	0	Measles Chicken Pox	5 yr. 0 mo.	41.0	39.0	G	G	Normal	Umbilical Hernia	0	0	0	N	N
314	7/6/27	M	115	16	8	0	Measles Chicken Pox Sucks Tongue	5 yr. 0 mo.	43.5	42.75	G	G	Normal	Normal	2	0	0	N	N
345	7/30/27	M	95	38	12	0	Measles Thumb-Sucking	4 yr. 11 mo.	41.0	37.5	G	G	Knock Knee Flat chest	Normal	0	0	0	N	N
362	6/22/27	M	80	62	12	0	Mouth Breather Before Tonsillectomy	5 yr. 0 mo.	40.0	32.75	G	F	Flat feet Knock Knee	Normal	4	0	0	N	N

*F = Fair; G = Good; N = Normal.

†Case No. 16 was only child who had received cod liver oil.

or none at all, there were present varying degrees of rickets. In order to have, for the present follow-up study, two groups between whom there were striking differences in infancy, we chose for the one group the forty children who had had the most marked rickets in infancy, and for the other group the forty children who had received the greatest amounts of irradiation and who had shown no evidence of rickets. We were able to locate and re-examine twenty-two of these eighty children. All of these are colored.

The protocols of the children are summarized in Tables I and II. Table I deals with the children who had a marked degree of rickets. Table II includes the children who showed no evidence of rickets in the first eight months of life. Reproductions of the roentgenograms of the wrists taken in infancy are exhibited for all the cases.

COMMENT ON TABLES

There is practically no difference in the average weights and heights of the two groups at the present time.

The estimation of the state of nutrition, which is based on both the height-weight relationship and the clinical impression, gives a higher incidence of mild malnutrition in the rickets group.

There were no pronounced bony abnormalities in either group. One child in the nonrickets group showed a moderate defect, that of flat feet. Knock knees of a mild character occurred in both groups. Pigeon breast occurred only in the rachitic group but was of slight degree.

Abdominal findings were about the same in both groups.

It had not been expected that there would be much difference between the groups in the deciduous teeth since these are calcified mainly during prenatal life, but, as a matter of fact, it was found that the main difference between the two groups lay in the teeth. There were 31 carious molars or canines in the ten children of the rickets group as compared with 25 in the twelve children of the nonrickets groups. All of the children of the rickets group showed caries, while five of the nonrickets group had escaped caries. It may be argued that this difference was dependent more on the care of the children since infancy than on the presence of rickets during infancy since there was found a greater incidence of caries among those children showing malnutrition than among those whose nutrition was satisfactory. Similar findings had been observed by us[6] in another study. Apparently the contagious diseases of these children bore no definite relation to the incidence of caries. The permanent teeth had erupted in only a few instances and showed no differences between the groups.

The noteworthy finding on comparing the two groups is that there is very little difference between them. Should subsequent investigations demonstrate the same finding, the conclusion would be justified that rickets in infancy has but little effect on the later development of chil-

dren. The importance of ascertaining whether this is true is obvious and justifies the presentation of other carefully controlled studies similar to the present one.

However, in view of the lowered resistance to infection during infancy, the possibility of tetany and the other commonly accepted dangers of rickets in the acute and healing stages, the desirability of the prevention of this disorder in infancy should not be minimized.

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INCONTINENCE IN CHILDREN

BERT I. BEVERLY, M.D.
CHICAGO

INCONTINENCE, in the absence of abnormal physical signs, is generally recognized as a psychiatric problem. This report deals with about 250 cases, mostly nocturnal enuresis, which have been studied at the psychiatric clinic of the Children's Memorial Hospital and in private practice during the past seven years. All hospital cases were referred by the general medical clinic where no evidence of organic disease was reported. Many of the cases were seen by the urologist who reported negative findings. The neurologic examinations were negative. I wish to comment on the outstanding findings which influence the general conception to be taken toward the condition and indicate a method of treatment. In discussing the causes of any behavior it must be remembered that we are considering factors only. The cause includes all the reactions of an individual to his environment from the time of birth.

Any explanation of incontinence must take into account many facts which are obtained from the study of a large group as well as individual case studies. It has been observed by many that the majority of cases are boys. In this series 64 per cent were boys and 36 per cent girls.* If the boys are considered separately additional facts are presented. Fifty per cent were below average weight for their height and 24 per cent were more than 10 per cent under average weight. A large percentage had small bones, small muscles and were of the slender type. A strikingly large percentage were "puny" boys. Here, as in most psychologic observations, there is no accurate method of measuring factors—hence figures cannot be given. The readers' observation of cases alone can verify the accuracy of the observations. A large percentage of the boys had an immature or effeminate physiognomy. Many were described by the psychiatric worker who took the history as small or sweet, good-looking boys, who bore a striking resemblance to mother. Girls having incontinence did not have these characteristics. There are many reasons why one should expect different behavior and different mental attitudes from this type of boy. Mothers enjoy keeping their children babies as long as possible. These small boys give her a better opportunity to gratify this desire for a longer period. Mothers protect them. They are kept in the home longer and not allowed to play with other children. These boys often belong to the so-called underweight group and are subjected to all of the insults which have

From the Children's Memorial Hospital.
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*The statistics given in this paper are based on 100 consecutive clinical cases.

been heaped upon that unfortunate group during the past twenty years. Over 75 per cent present feeding problems. Children with small stature create more apprehension in parents. Apprehension of parents is always transmitted to the child. This fearfulness is further increased by the boy's inability to compete and defend himself with other children. Boys among boys are judged by their ability to wrestle, fight, play football, etc. These small boys are therefore greatly handicapped. They are kicked out of games, called "sissy," given girls' names, and have a much harder time making a satisfactory adjustment. In talking to them, therefore, it is not surprising to find that they think they are weak and have something the matter with them; or they boast of their ability to cover up their strong feeling of inferiority on a physical basis.

All of the patients are scared. Nearly all parents report that the child is nervous. By nervousness they usually mean fearful, marked activity, infantile habits such as thumb-sucking, nail biting, frequent crying, etc. Scary dreams of being taken away by robbers, kidnappers, ghosts, etc., is a constant finding. As emphasized by Hamill* when they are asked who the robber or kidnapper was or who he resembled the child not uncommonly replies father. In this connection it is well to recall that any individual will lose control of his sphincters and wet himself if sufficiently scared. As a part of this fearfulness is a striking lack of a sense of security and self-confidence. There is then an absence of two of the essential attributes for growing up and taking on responsibilities.

Jealousy is a common finding. Although obvious, it is usually unrecognized or its importance underestimated. Incontinence commonly develops after the birth of another baby or when another child in the family gets sick and receives a great deal of attention.

The attitudes of parents are important. A few illustrations will best describe this factor.

J. O. (Case 1), an intelligent nine-year-old girl began wetting the bed when six years of age. The difficulty began during the first year at a parochial school. She was afraid of the teacher and forced to use her right hand, although a left-handed child. She is the second of three children. An older brother has many problems. Although very intelligent he has marked difficulties in school by reason of reading, writing, and spelling difficulties. This was interpreted by the parents and teachers as mental retardation. He had frequent attacks of asthmatic bronchitis and upper respiratory infection. For these, and probably other reasons, the parents, especially the mother, assumed a protective attitude toward him. No one, especially J., was allowed to tease him. He received most of the attention. J.'s younger sister was born about the time the enuresis developed. She is a very attractive child

*Personal communication.

and also favored by the parents and relatives. J. very soon began to do things which were interpreted as mean. She was scared and punished a great deal. She began to wet the bed. An outstanding finding when she was presented for treatment was her feeling of not being liked. In talking to the parents, especially the mother, it was obvious that the child was not liked. The mother stated, "She must have something the matter with her mind."

W. C. (Case 2), a fourteen-year-old girl wet the bed from birth. Father deserted the family when she was four years old. The mother subjected her to extreme criticism. History brought out that this child was born five months after the parents' marriage. The patient looked like her father. The mother was extremely resentful toward the father and had a marked sense of guilt because of the forced marriage. She transferred this resentment and self-criticism into a hatred of the child.

The mother of W. C. (Case 3), a ten-year-old boy who had diurnal and nocturnal enuresis thought he was just like his father who was no good. In 9 per cent of the cases, parents were separated or one parent dead.

The attitude of the father of an eight-year-old girl (Case 4) who wet the bed is illustrated by his becoming furious when he found she had taken two cookies instead of one. He told her that he could not stand deceit or lying, gave her a spanking, and sent her to bed.

C. S. (Case 5), a seven-year-old boy with an I. Q. of 125 soils and wets himself. The mother wanted a girl, and since she did not get one, decided to make one of the patient. The patient being a small, sweet type of child, aided her materially. She protected and spoiled him to the extreme. As his incontinence became repulsive to her fastidious nature, however, she combined spoiling with nagging. The father, anxious to have a big, robust football player type, approached the boy from the opposite and almost equally extreme viewpoint. A very fine nurse of forty years of age tried to follow strict pediatric orders to the minutest degree. She spent most of the time waiting on him and "teaching him to be a man." As a matter of fact she used him as an emotional outlet for herself. In teaching him how to do things she did everything for him and made him dependent upon her. She even did the school work for this boy of superior intelligence. We had, then, three adults with divergent attitudes excepting a common factor—dissatisfaction—surrounding this puny boy. Naturally he was confused, scared, felt inferior, and was infantile in his reaction.

J. L. (Case 6), an eight-year-old girl began wetting the bed three different times in two years. Each time the condition was precipitated by the mother's anxiety over the patient's behavior in the neighborhood. As soon as the mother let the child alone, the enuresis stopped. When she again became too anxious, enuresis reappeared. We see these patients, then, subjected to unusual spoiling or overcriticism not be-

cause of anything in the child, but as a reflection of the parents' own problems and therefore distorted attitudes toward the child.

As already indicated, information regarding the factors which precipitate incontinence is derived from studying the conditions under which it begins and stops. A seven-year-old girl (Case 7) began soiling and wetting herself while she had scarlet fever. The condition frequently begins with an illness. At this time they are often frightened. When children are sick they are treated like babies. To become infantile when ill is a common reaction even in adults. Children enjoy this situation and often try to continue it after recovery. They develop incontinence when another baby is born, when mother falls ill or father is sick and has to stay home and have absolute quiet. J. N. (Case 9) began diurnal enuresis after the amputation of a leg by a train. In his own words, "I wet my pants when out with other boys. They can jump and run. I can't. I get mad and do it."

While incontinence is a reason for bringing the patient to the doctor, it is only one of many complaints which are easily illicited by a careful history. Nervousness is nearly always described. Other infantile habits such as temper tantrums, thumb-sucking, nail biting and infantile speech are sometimes present. School problems are encountered. A large percentage are dietetic or constipation problems. A large number do not play with other children. They often have nightmares, etc. In other words, the incontinence is but one of a number of manifestations of a general behavior problem. One never finds incontinence as the sole problem. This is of extreme importance in determining the attitude one should take toward the condition and its treatment.

We might go on at greater length describing the various environmental and innate difficulties which surround these patients. As one would expect, no two cases are alike in detail. There is, however, one common finding, the child is having a hard time growing up. Under difficult circumstances we recognize a frequent type of reaction; namely, throwing off responsibility. When things are too difficult for an individual he sometimes feels like quitting and doing nothing. This is, of course, an infantile reaction. In the same manner these children remain infantile or return to their infancy when growing up is made too difficult. Conditions may be too difficult because of innate characteristics of the individual (stature in boys, for example) or because of an unfavorable environment. Incontinence then is first of all a symptom. It means that this child cannot grow up and take on the responsibility expected of him.

Thus far we have considered the more superficial positive factors causing incontinence. In many cases the problem is much more complicated. This is illustrated by the following case. R. D. (Case 10), a ten-year-old boy was referred because of fecal and urinary incontinence. He was the second of five children. The economic situation was poor,

The father was an alcoholic who apparently disliked the patient. He criticized and beat him a great deal. The mother was a passive type of person who tried to protect the children and accept conditions as best she could. Before the development of the soiling the patient was blamed for the severe burn of a brother. The boy was a small, bright-eyed, light complexioned child. He did not get on well with the other boys and was the subject of their ridicule. As the incontinence improved he soiled during the day and wet the bed several nights after he had been beaten by the big boys. He had defective vision and was uncomfortable without glasses. At two different periods the incontinence became worse when the glasses were broken. He expressed fear of other boys and his father. He thought he was no good. He had many dreams at night in which he was taken away and killed. His daydreams were especially interesting. He often imagined himself to be a baby lying in his mother's arms and nursing. He further imagined he was soiling in a diaper and mother would get up and change his diaper and clean him. He enjoyed this part of the daydream. During the daydream he would actually soil himself. Many conclusions can be drawn from a case of this kind. We see a child's mind retrogressing to the nursing and diaper stage of development which is universal in character. In his daydream, which represents his conscious wish, he goes back to his infancy. He expresses a conscious resentment and fear of his father. In this process we see a strong attachment for his mother which he refuses to relinquish. It is obvious, therefore, that the incontinence is but one symptom of a deep-seated personality disorder.

R. H. (Case 11), a seven-year-old boy with an intelligence quotient of 1.04 was referred from the medical clinic with a diagnosis of post-encephalitis because of occasional spells of polypnea. The neurologic examination was entirely negative and the subsequent findings changed the diagnosis to apprehension. The history as obtained by the psychiatric social worker was as follows: The patient had peculiar spells of staring and rapid breathing for two years. He seemed to have them when frightened. He had a spell when he spilled some medicine on his clothing which he thought was poison, after seeing scary movies, at Sunday school, etc. At other times he seemed to have them to get attention, and stopped having attacks in school when the teacher told him that he could not disturb the room. He was extremely apprehensive. He became severely upset when he saw a house on fire at two and one-half years of age. At two years he was severely frightened on a trip. At that time he cried a great deal at night and did not want to sleep alone. At school he was inattentive and although he had the ability, would not do the required work. He "hollered" and did things to get attention and told his mother, "he talked goofy and did not have to do the work at the blackboard." He had nocturnal enuresis on and off since birth. He sometimes went for a month or six weeks with-

out wetting. Medicines, shaming, and all sorts of devices were used to cure the condition without effect.

The social worker described him as "an attractive brunet boy with olive brown eyes and hair and dimples like his mother." He was a slender boy, small for his age. He was very clean and immaculately dressed, as was the mother. The boy did not adjust well with other boys. He preferred to play with little girls, as the boys were too rough, called him "sissy" and girls' names and teased him. He did not get on well with his younger sister and became furious when she received attention. The patient was a sickly baby. He vomited a great deal and his mother was sure she would not rear him. The mother was a very fearful individual, much like the patient. She had an unhappy childhood and married partly to get away from home, only to have to move on the second floor above her mother. Her mother dominated her completely. She never dared disobey and was constantly nagged at home. The father was a good-natured type of individual who soon discovered his ideas about the rearing of the children were rebuked or ignored. He therefore paid little attention to them and allowed the mother and grandmother to take full charge of the home.

Psychiatric examination brought out many important facts. Bob was very fearful of other boys, of the dark, etc. He had many scary dreams. He dreamed that a witch came in his room and beat him with a broom. His description of the witch was the one pictured in books. When asked who the witch reminded him of he said one night she took her mask off and it was his mother. He talked a great deal about bad and nice things. He wished to be a girl because boys were bad and did nasty things. He was thoroughly scared of touching himself and of all sex matters. In other words mother's fears had been thoroughly impressed on the child. As in the previous case, his daydreams or wishes were to remain a baby. He imagined himself a baby in a crib (he indicated its length). He enjoyed imagining he was sick and mother was bending over the crib giving him medicine, changing his diaper, etc. Here, again, we see a deep-seated, complicated mental problem of which the enuresis was but one symptom.

The most important thing about incontinence, especially emphasized by Hammill,[1] is that these children stop when they want to. This should probably be amended to state that children stop when they want to, and when a sufficient motive has been furnished. That individuals can be responsible for themselves while asleep has been demonstrated.

The treatment may be considered in three parts; first, making the child responsible for himself, second, psychotherapy, and third, adjustment of environmental difficulties. These children can stop incontinence as soon as they want to or as soon as proper incentive is furnished. The first step, therefore, is to emphasize to the child that he can stop. It is surprising how many will stop soiling or wetting as soon as they are

told it is possible. In this series 10 per cent stopped their enuresis with one or two visits to the clinic. They were cured by making them responsible for the condition, giving them praise, and asking the parents to let them alone. Many children want to stop but make no effort because they have been convinced the condition is due to weak kidneys, weak bladder, sleeping too soundly, etc. The restriction of fluids, waking patients at night, giving medicines (or using any of the innumerable devices) are definitely contraindicated. It is true that any of these measures that have one common active therapeutic principle—suggestion—may clear up the incontinence. It does not teach the child self-responsibility or improve his personality difficulty, however. On the contrary it teaches him there is something organically wrong when there is no evidence of disease. This is one outstanding characteristic of the neurotic individual.

Psychotherapy consists of building up the child's sense of security and confidence, analyzing his fears and straightening out the innumerable wrong impressions and mental conflicts which vary with the individual patient. It consists in helping the child work out his difficulties in adjusting himself to the particular environment which surrounds him. It is important to convince him that there is nothing the matter with him, that he is a bright child, that he can do what any other child can do. It is important to point out to him that he is scaring himself and help him analyze the many fearful dreams which increase his apprehension, etc. Adjustment of the environmental conditions is usually obvious. The parents must be convinced there is nothing the matter with the child. Their own problems often have to be investigated in order to point out to them that they are reading into the child abnormalities which do not exist. They have to be given instructions regarding the feeding problems, methods of discipline, etc. Much can be done by praise on the part of the parents and teachers. Getting the child into clubs or where there is supervised play in order that he may be taught how to get along with other children is of great value.

The results obtained depend on one's ability to carry out this program. In this series 31 per cent were cured, 33 per cent improved, 7 per cent unimproved and there was no report in 10 per cent. The latter group includes those who did not return to the clinic a second time because of refusal to accept the form of treatment, sickness, etc., and those concerning whom the social worker could not find out what happened. The number of visits varied from one to forty and did not average more than ten to fifteen minutes each—a time which is entirely too short to get good results. Like most figures of this kind, they are of little value. A consideration of the many factors in each case is essential to the understanding of the reasons for or against improvement.

What is more important than the progress of the incontinence is the degree of adjustment of the patient to his environment. The incon-

tinence often stops only to begin again when difficulties arise. Robert (Case 11) stopped the enuresis many months ago but is still not completely adjusted. Some of his personality difficulties remain and for that reason he is still under treatment. The incontinence must be considered as a symptom—analogous to a fever. The chief concern should be to determine the other symptoms and attempt to find the underlying cause of the difficulty. Just as we are more concerned about the cause of the fever and other symptoms, so we should primarily be concerned with the cause of the incontinence and other symptoms. Just as we no longer treat the fever primarily, but its cause, so we should no longer treat the incontinence primarily, but the cause. Just as the fever disappears when its cause has been eradicated, so the incontinence disappears if the underlying cause can be eradicated.

SUMMARY

1. This report deals with about 250 cases of incontinence (mostly nocturnal enuresis). It includes cases seen at the clinic and in private practice.

2. Incontinence is but one of many symptoms in every case. It is but one manifestation of a general behavior disturbance.

3. Children remain infantile or return to their infancy when growing up becomes too difficult, the incontinence being one symptom of the infantilism.

4. The factors causing the incontinence include any innate characteristic or environmental condition which makes growing up and taking on responsibility too difficult.

5. The causative factors may be superficial or include deep-seated personality disorders.

6. The treatment consists in teaching the patient responsibility, psychotherapy, and adjustment of environmental conditions.

7. It is more important to treat the underlying maladjustment than the symptom.

REFERENCE

Hammill, R. C.: J. A. M. A. 93: 254, 1929.

8 South Michigan Avenue.

POSTOPERATIVE MASSIVE ATELECTASIS OF THE LUNG

CASE REPORT

GEORGE B. BADER, M.D.
NEW YORK CITY

PATIENT V. V., aged twelve years was admitted to the hospital service on February 22, 1932, with the diagnosis of acute appendicitis and peritonitis. The symptoms of appendicitis had existed for 2 days previous to admission during which time he had been given epsom salts and milk of magnesia but with prompt emesis. His temperature on admission was 101° F. His blood count was W.B.C. 16,250, with a differential of 92 per cent polymorphonuclears and 8 per cent lymphocytes. He was promptly operated upon. The appendix was found to be retrocecal, gangrenous and ruptured at its tip with free pus in the right lower

Fig. 1.

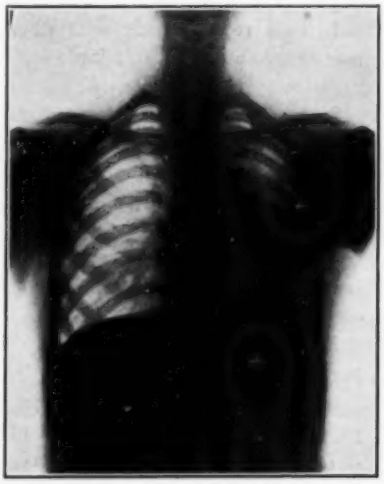

Fig. 2.

Fig. 1.—Four days postoperative. Note the dense shadow on the left side of the chest with the disappearance of the cardiac image and the mediastinal contents from the right side of the chest. The intercostal spaces on the right are more widely separated than those on the left due to compensatory emphysema.

Fig. 2.—Five days postoperative. Note the increased aeration in the left upper lobe, the elevation of the diaphragm on the left and the widening of the intercostal spaces on the right side.

quadrant. The incision was right rectus, 5 centimeters in length, and cigarette drainage was instituted. The anesthetic was open drop (ether) and the narcosis was not unduly prolonged. The operation lasted 30 minutes. The child was placed in the Fowler position, postoperative, after patient had recovered from anesthesia.

There was nothing in the previous history except pneumonia 6 years ago and tonsillectomy and adenoidectomy 4 years ago with uneventful recovery. The tuberculin skin test was negative and no pathology was found in the chest before the appendix operation.

From the Pediatric Service at St. Vincent's Hospital, New York City.

Request for a consultation the first day postoperative because of respiratory difficulty revealed signs indicative of an acute bronchitis, râles disseminated throughout the chest. He presented the clinical aspect of a postoperative pneumonia, with rapid labored breathing.

The child was seen again four days postoperative at which time he appeared to be very much worse. He was dyspneic, cyanotic and the left chest was prac-

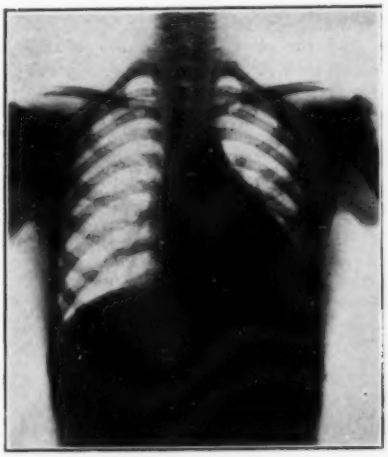

Fig. 3.

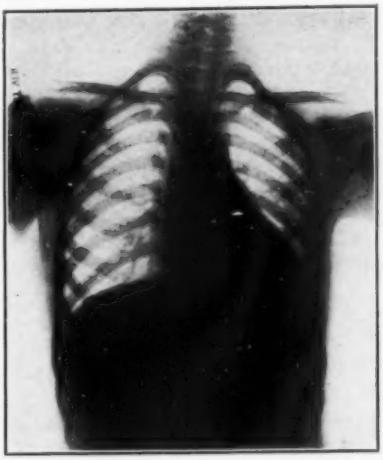

Fig. 4.

Fig. 3.—Nine days postoperative. Note the progressive increase in aeration of the left lung. The cardiac image is still to the left.

Fig. 4.—Eighteen days postoperative. Aeration of the left lower lobe extends to the base on this date.

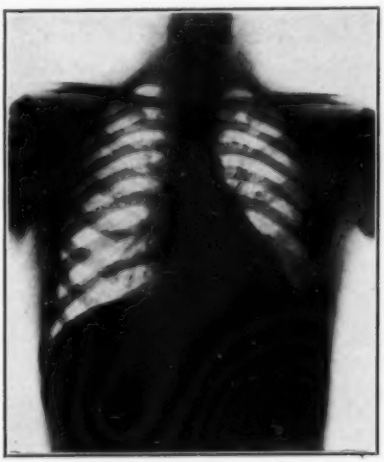

Fig. 5.

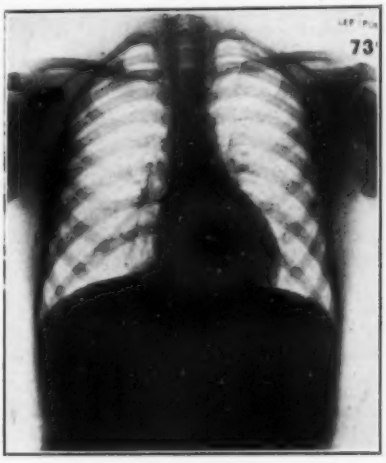

Fig. 6.

Fig. 5.—Twenty-six days postoperative. Lung expansion is nearly complete.

Fig. 6.—Fifty-eight days postoperative. Shows complete expansion of the left lung. The heart occupies its normal position with the return of the cardiac image on the right. The left diaphragm presents a normal relationship to the right and the intercostal spaces are symmetrical in width on the two sides.

tically immobile. He had signs in the left chest which were interpreted as fluid, the breath sounds over the left side anteriorly and posteriorly being greatly diminished and with diminished tactile fremitus. No râles were heard over this area. At the extreme apex of the left upper lobe, however, there was loud bronchial breathing with râles.

An x-ray picture was taken at once which revealed what is seen in Fig. 1. Thereafter a series of pictures was taken which show the progress to complete recovery. (Figs. 1 to 6.)

Temperature continued nine days. This and the slow disappearance of the shadow in the left chest were attributed to a small amount of fluid. A thoracentesis was done, however, without success except for a few drops of blood which were reported sterile. In this instance no special treatment was instituted. Recovery is apparently complete after 57 days.

CONCLUSION

I believe this condition is sufficiently unusual to warrant attention and although apparently rare in children or perhaps rarely recognized, I suggest that the condition be anticipated in all instances of so-called postoperative pneumonia.

BASAL METABOLISM STUDIES IN OBESITY IN CHILDREN

CHARLES GILMORE KERLEY, M.D.
NEW YORK

OUR attempts in determining the basal metabolism in children covers 247 units which means that several hundred tests were carried out; we have found in this study that much care has to be exercised to secure results of any value. The apprehension and emotional state of a child under this procedure are in many children of such a degree of intensity as to render the test of little value. It is quite impossible for many children to lend themselves to the details required. A scolding or a quarrel, the resentment caused by the absence of the usual breakfast, the beginning of an illness, the onset of menstruation, the suggestive furnishings of a physician's office all may influence the findings. A boy who had been consistently minus in several tests suddenly registered plus 40. Outwardly he appeared as usual but confessed later to having been much perturbed by my direction to the technician for a blood examination after the metabolism test. The dread of a finger prick and a persistently minus boy was transferred to a plus 40 boy. The findings in 57 children were discarded as valueless from a basal metabolism standpoint.

The plan employed is to have the patient appear at 10 A.M. without breakfast. The test is carried on in an ordinary bedroom with bedroom furnishings, and all tests were made by the same young woman technician. The Sanborn apparatus was the only object in the room other than quite ordinary bedroom furnishings. We believe that the surroundings in a physician's office may play a considerable part in exciting apprehension in the timid or otherwise influencing emotion; the test is made behind closed doors—for twenty minutes preceding the test the child rests recumbent on the bed and reads a simple story or is read to by an attendant. None other than the technician and attendant are allowed to be present.

Thirty-one children without illness that would have a bearing upon the basal metabolism were employed as controls. The study further covers repeated tests on 12 cretins who have been under my care from five to thirty-two years. The cretins were employed as check-ups on our Sanborn apparatus and particularly to evaluate our technic. They were under thyroid gland administration, which was suspended and readministered for different periods unbeknown to the technician, who invariably detected when the patient was taking thyroid and when it was withheld.

Among those in whom we considered the observations reasonably accurate were 52 children who came to us because of obesity as the outstanding complaint, 35 females, 17 males. The ages ranged from five to twelve years; only those who were 15 pounds or more overweight for height were included in this group. The extremes were held by a boy 15 years of age who was 55 pounds overweight for height and a girl 16 years of age was 74 pounds overweight for height. In 34 there was obesity without other complaint or evidence of illness. The findings in this group were:

28 normal +10 to –10
6 ranged from +15 to +45
10 comprised the minus group with the range of –12 to –40

In the 6 who comprised the plus group partially controlled emotion doubtless played a part. It is also possible that among these the incidence of puberty may have been a factor.

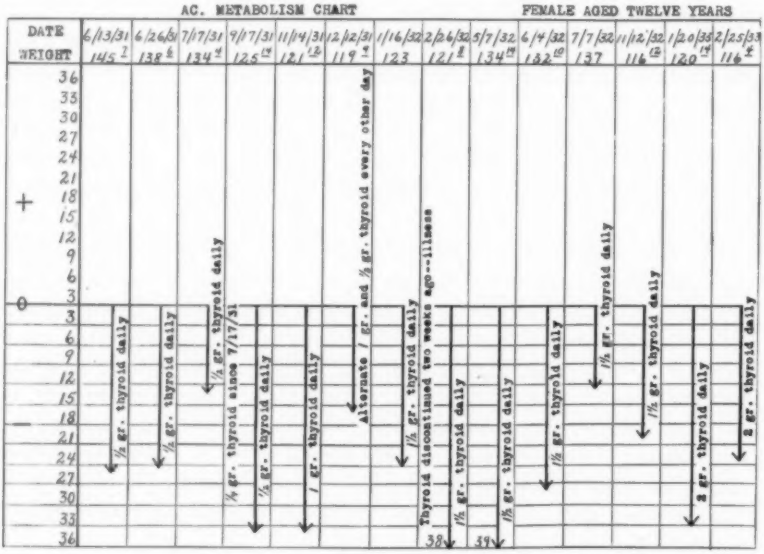

Fig. 1.

The minus group represented evident thyroid dysfunction. There were 7 girls and 3 boys with the range of –12 to –40 all of whom were benefited by thyroid gland administration. An interesting observation in 5 girls who were from 32 to 55 pounds overweight for height was our inability to raise the rate to the normal by increased thyroid gland administration because of sleeplessness and extreme irritability. The loss of weight and the improved condition of the patient warranted the

continuation of the gland substance in reduced amount. Many tests were made on these patients. The greatest number was 22 in one individual covering a period of three years.

The response of a child to thyroid gland administration is shown by the chart (Fig. 1). A girl twelve years of age 55 pounds overweight for height came because of obesity with the complaint of lack of initiative and poor work at school. A rapid increase in weight and the change in conduct had been noticed for three months. The administration of thyroid gland dessicated from one-half to two grains daily was given for a period of 18 months. During this time there was a loss in weight and return to the normal school and family reactions. It was impossible to raise the metabolic rate to the normal as is shown by the chart. Attempts in this direction invariably resulted in extreme irritability and sleeplessness.

In 8 additional abnormalities or ailments were present. A boy and three girls from nine to thirteen years of age were overweight for height 28 to 37 pounds; in all there was thyroid gland enlargement with normal metabolic rate. In these Lugol's solution was given 2 drops twice daily from three to six months' period. All made satisfactory improvement and are normal children today.

A girl twelve years of age thirty-seven pounds overweight for height with enlarged thyroid, neurasthenia, persistent tachycardia showed the anomolous condition in that the metabolic rate was –30. The mother refused to cooperate in the plan of management suggested and the child passed from under observation.

Three boys, one ten years of age and two twelve years, ranged from 15 to 31 pounds overweight for height. All showed evident thyroid and pituitary dysfunction. In each the penis was small and flabby, the testicles small and soft, in size those of a normal infant of one to two years of age. Repeated tests varied from –15 to –30. One aged twelve years was under observation for 13 months with an initial rate of –30. Dessicated thyroid 3/10 grain with 2 grains of dessicated whole pituitary were given for 11 months. Marked improvement resulted—the testicles became firm and developed normally. The metabolic rate reached the normal after nine months and the medication was omitted with an increase in weight however of 8¾ pounds. It was impossible however to raise the rate above –10 because of irritability and sleeplessness.

The remaining two, aged, respectively, ten and twelve years, were under observation with thyroid and pituitary gland therapy for three years—22 tests were made in one and 17 in the other. Dessicated thyroid and whole pituitary were given during this period. There was an average daily intake of ½ grain of thyroid and 6 grains of pituitary and both made satisfactory improvement. A normal metabolic rate was reached and later maintained without gland therapy. Early improvement was

indicated by a loss in weight, and evidences of normal sexual development. These boys after one year free from gland administration are in every respect normal individuals.

COMMENT

It has been our observation that obesity in children is usually of a temporary nature. The great majority of fat boys and girls swing into line with their forebearers about the time of puberty. A follow-up study of the cases reported bears out this observation. Height, weight and bodily characteristics follow closely along ancestral lines. If endocrine gland secretion plays a part in the fat child, the dysfunction is but temporary in the great majority. It would appear that in some children such a dysfunction exists and in these gland therapy is of assistance.

In our observation of obese children in which the metabolism studies were carried out, in but one (Fig. 1) has there been an approach to myxedema. In this girl inheritance doubtless plays a part as the mother requires and has been taking for many years 5 grains of dessicated thyroid daily.

The omission of fats and sugars from the diet and the arrangement for bodily activities is all that appeared to be required to bring the obese child to a condition of normalcy unless pronounced hereditary factors were present.

132 West 81st Street.

CHILD TRAINING IN OLD MEXICO

JOHN RUHRÄH, M.D.
BALTIMORE, MARYLAND

THE Aztecs were a remarkable people with a highly developed civilization which, like all so-called civilizations, had much that was good and much that, at least to us, seems objectionable. Curiously enough they had no written language but used instead a system of picturegraphs with which they recorded the history of their conquests and other events of importance. These are suggestive of the newspaper strips of the present day.

With the conquest of Mexico by the Spaniards came a new order of things and the conquistadores, burning with religious zeal, destroyed almost all of these records and some of the few which escaped are now to be found in various libraries and museums of the world. At the time of the conquest, about 1540, the viceroy Mendoza had an elaborate picturegraph made so that the King of Spain might know just what manner of people had been annexed to his kingdom. This was the work of the native wise-men and is known as the Codex Mendoza. It is now one of the treasures of the Bodleian Library, at Oxford, where it might have lain unknown to the world had it not been reproduced in a magnificent color facsimile by Lord Kingsborough in his sumptuous volumes on the Antiquities of Mexico which contain various codices and pictures and drawings of the ancient monumental buildings. This venture cost Edward King, the son of Lord Kingston, who had the honorary title of Lord Kingsborough, over £32,000. Quarrelling with his paper maker over a trifling amount he was thrown into a debtor's prison in Dublin where he died of typhus fever. In the text, which is bilingual, English and Spanish, Lord Kingsborough sought to show that the Aztecs were the lost tribe of Israel and pointed out numerous resemblances in ceremony and ritual. However interesting, this need not concern us here.

Through the courtesy of the directors of the Peabody Library of Baltimore, the author has been able to reproduce a few of the plates of the Codex Mendoza. These give an account of the child culture in vogue at that time and it was a subject in which the Aztecs had very pronounced views, as, indeed, they had on most subjects. Their medicine was crude but so was the medicine of all nations at that time. They had elaborate public health regulations which extended to the use of alcoholic drinks of which they had pulque. Their methods would have delighted the anti-saloon league, for if an aristocrat got drunk they killed him and if a commoner he was sold into slavery. On occasion pulque was given to children.

There was a caste system, with aristocrats and commoners. The priests and the military were the ruling classes. Boys were trained to enter either one or other of these professions and in the trades and the girls for their wifely duties, but some of the girls who did not incline to matrimony, following what seems to be a universal custom, acted as priestesses and attendants in the temples. The Aztecs were strong in vocational training. The cultural as we know it had no place but was replaced by a knowledge of ceremonial and customs.

The Aztecs tried to avoid behavior problems by careful feeding, on the principle that too much food makes for sloth, and by the very practical method of keeping the children occupied. A busy child has not time to be bad. Such deviations from the path of rectitude as occurred were managed according to the Solomonic dictum of spare the rod and spoil the child, what we might name today the Brennemann method, as suggested in his recent article in this JOURNAL.

An outline of the Aztec methods may be gleaned by reading the accompanying plates and the following notes abridged from the Kingsborough text will be found helpful where the imagination, and but little is needed, fails. The mother is shown in the plate *(1)*. As soon as the child was born, it was put into a basket *(3)* and when it was four days old (the four roses *(2)* above the child indicate four days) the midwife *(4)* carried the naked child in her arms into the court of the mother's house. The floor was strewn with rushes, which they called "Tule," and upon them a small vessel of water was placed, in which the midwife bathed the infant. After this the child was named by three boys *(6-7-8)* who were seated near the rushes, eating a mixture of roasted maize and boiled beans, called "Yxcue." The boys pronounced the name of the child, a name evidently given them by the midwife. If the child was a boy, when they carried it out to bathe it, the child carried in his hand (sic) a symbol *(5)* which represented the father's employment either in the army or of his trade. If a girl, she carried the symbol of a spinning wheel and distaff with a small basket and a handful of brooms.

The umbilical cords of the boys, with symbols, shield and arrows, were buried in a place where they were likely to have war with their enemies. The cords of the girl babies were buried beneath the *metate*, the stone on which they ground meal. Twenty days afterward the parents went with the infant to the temple which they called *Calmecas*, and in the presence of the priests presented it with its offerings of mantles and maxtles, together with some provisions. After this the child was brought up by its parents, and when it arrived at a proper age it was delivered to the high priest to be instructed, if the child was to become a priest, or if he was intended for the military they offered him to a master called *Teachcauh* or *Telpuchlato*, together with provi-

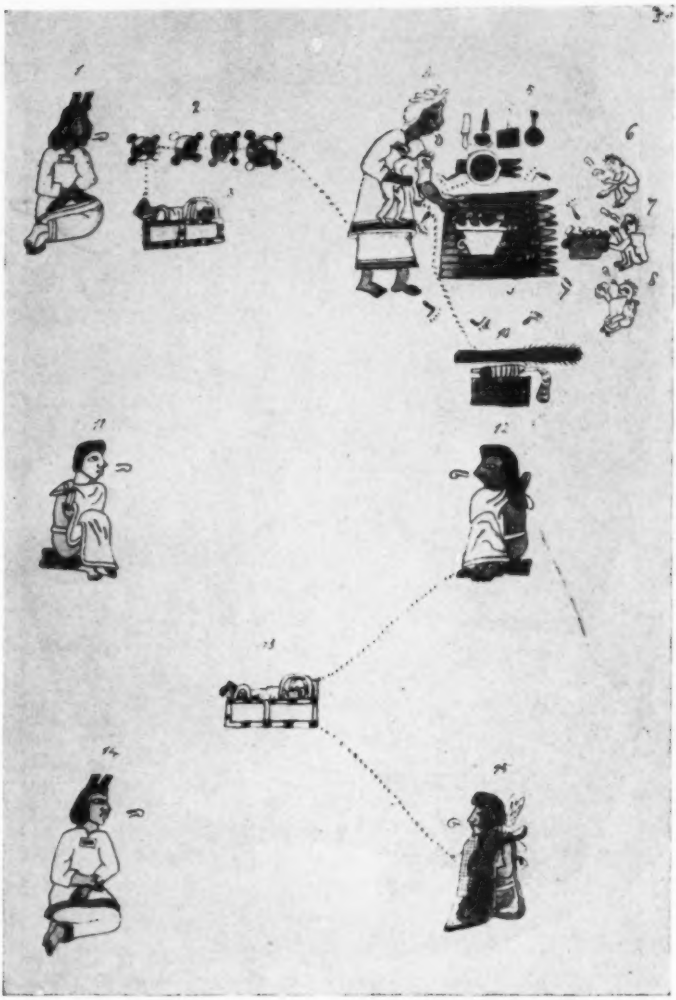

Plate I.—Child life as illustrated in the Codex Mendoza.

sions and things for a celebration, and when the child was of fit age they offered him to the master.

In the plate the rushes and the vessel with water are shown *(9)*. The ornamentation on the top of the pot is the symbol for water. The brooms, distaff, spinning wheel and basket are also shown *(10)*. The father *(11)*, the high priest *(12)*, the infant in the basket for the presentation *(13)*, the mother *(14)* and the master of the boys *(15)* are also figured.

Plate II.—Child life as illustrated in the Codex Mendoza.

In the other illustrations the education of the child may be followed. The circles represent years. Throughout these the father is shown dealing with the boys and the mother with the girls. The amount of food allowed is indicated by half a loaf, a whole loaf, a loaf and a half and two loaves. The sign before the mouth of the parents represents speech and it may be taken to mean that the parents are advising their children. The children, it will be noted, do not answer back, thereby showing a difference in the Aztec method and present-day

Plate III.—Child life as illustrated in the Codex Mendoza.

training. At four the boy helps by carrying water; the girl is told about spinning. The distaff and wool are seen. In the next picture the mother instructs the girl and at five years of age the girl is practising spinning herself, and more successfully at six years of age. The boy at three is guided by the father, at four he helps by carrying water, at

Plate IV.—Child life as illustrated in the Codex Mondoza.

five by doing errands and picking things up in the market. At seven the boy is instructed in fishing. At eight both parents are telling the children if they are not good they will be stuck with thorns, and the children are weeping. At nine years of age the boys are punished for disobedience by tying their hands and feet and sticking the pointed agave leaves into them. The girls are stuck only in the hands and are not tied.

At ten the punishment is whipping and at eleven the children are punished by being held over a fire of dried *axi*, probably chili peppers, and made to inhale the acrid smoke. At twelve the boys are punished by being tied hand and foot and being put out on the damp ground to think it over, while the girls must clean the house all night. The symbol *(14)* represents the starry heaven or night—it suggests a cluster of electric light bulbs.

At thirteen the boys are instructed in boating and gathering wood and the girls in grinding meal and in cookery and, from the jar, we may judge in the preparation of drinks. At fourteen the boys are taught fishing and are doubtless adepts by this time. The girls are given instruction in weaving.

Thus we see the Aztecs, while not plagued with lessons from books, were given good instruction in all the occupations which fitted them for their life, were taught obedience, made to mind and taught moderation in all things.

Several things stand out plainly and these the Aztecs evidently regarded as their cardinal points in the education of children.

1. The avoidance of gormandizing and the careful regulation of the food.
2. The avoidance of idleness.
3. Strict punishment.
4. Vocational training.

All of these are sound in principle although the third today would be expressed better as strict discipline which, as far as American children are concerned, is conspicuous by its comparative absence.

WHOOPING COUGH: RÉSUMÉ OF A SEVEN YEARS' STUDY

LOUIS W. SAUER, M.D.
EVANSTON, ILL.

SINCE the day when devastating epidemics of whooping cough spread over parts of Europe, this disease has been studied by untold thousands of clinicians and investigators. By the close of the Nineteenth Century at least twenty microorganisms had been described as the cause of pertussis. The study by Bordet and Gengou of the Brussels Pasteur Institute in 1906 was so precise and conclusive that, to this day, no one has reported any other etiologic organism. The first book, *Der Keuchhusten*, by Sticker of Bonn, appeared in 1911. It contains a comprehensive historical, epidemiologic and clinical review. The salient points of over five hundred papers are abstracted and preserved in this volume. The only other book, *Pertussis*, was written by Pospischill of Vienna in 1921. He relates in great detail his unparalleled clinical experiences as chief of the Whooping Cough Hospital, through the portals of which over 25,000 pertussis patients had passed. The numerous subsequent papers of importance fall into four groups—epidemiologic, clinical (and therapeutic), etiologic (experimental), and diagnostic. That the whooping cough problem is worthy of study may be inferred from an excerpt from the 1928 U. S. Public Health Service Report: . . . "in the registration area about six thousand children under five years died from whooping cough. This exceeds the deaths from diphtheria, scarlet fever, measles or tuberculosis. It exceeds the deaths from measles and scarlet fever combined."

EARLY DIAGNOSIS

Pertussis is most contagious in the catarrhal stage, young children are most susceptible, and it is now fatal only for the very young. Easy as it is to recognize the disease when the cough is at its height, so difficult may it be to make an early diagnosis. Early diagnosis is desirable because more bacilli are disseminated during the catarrhal stage. Quarantine is seldom established before the period of greatest contagion has passed. If tardiness in diagnosis is a factor in prevalence, it must play an important rôle in the heavy toll among the very young.

Mauritzen suggested to Chievitz and Meyer, of the Danish National Serum Institute, that it should be possible to recover the Bordet-Gengou bacillus by exposing Bordet medium to a coughing pertussis patient. In 1916 they reported in *Annals of Institute Pasteur* of Paris on early diagnosis by the cough plate method. It has gained favor wherever it has been conscientiously tried. A positive plate is indisputable

From the Evanston Hospital and Northwestern University Medical School, Chicago.

evidence, but negative plates do not exclude pertussis. It is an aid only in *early* diagnosis and, like many other laboratory aids, is not infallible. As mastery of the technic is important, Petri dishes should at first be inoculated with *B. pertussis* and incubated. The cultural characters of the minute, round, elevated, shiny gray colonies can thus be studied from day to day. Duplicate plates should then be exposed to early cases of known pertussis. Overgrowth by mouth saprophytes can, in part, be avoided if the child drinks water just before the plates are exposed. The uncovered culture medium should be held vertically, a few inches from the open mouth at the moment of several expulsive coughs from the deeper bronchi. If the cough has already persisted for several weeks, plates should be exposed to the other nonimmune children of the family. More bacilli are expelled during the catarrhal stage. Plates should be in the incubator within twelve hours after exposure. Only those well exposed should be incubated. A hand lens, used in bright light, is helpful in finding the minute, raised, circular colonies on the third day. The diameter approximates one millimeter. A characteristic, darkened zone surrounds each colony. This zone and the colony appear translucent in transmitted light.

PREPARATION OF COUGH PLATES

Five hundred grams of peeled, sliced potatoes are boiled in 1000 c.c. distilled water and 40 c.c. glycerin. When the potatoes are soft, adjustment is made to the original weight, and the mixture is strained through gauze. To 500 c.c. of the filtrate 1500 c.c. of 0.6 per cent salt solution and 60 gm. of agar are added and autoclaved. The temperature of the medium should be 45° C. when it is added to a fourth as much fresh, defibrinated, blood (warmed to 45° C.). After mixing without air bubble formation, it is poured into sterilized aluminum culture boxes (4 cm. × 1.5 cm.). They require very little medium, can be transported conveniently and dry out slowly with a broad rubber band over the seam. Boxes should be dated when they are made and exposed, and should be stored (in refrigerator) and incubated in an inverted position. They are usually good for about two weeks. The medium should be bright red, the surface smooth and moist.

During the past seven years we have used the cough plate in 400 cases of the disease. It was positive during the catarrhal stage in 88 per cent, during the paroxysmal in 64 per cent, and no culture was positive in the decline period.[1]

Differences Between B. Pertussis and B. Influenzae[2]

Appearance of Colonies

At the end of three days on Bordet-Gengou medium, colonies appear to the naked eye as tiny, glistening, mercury-like droplets. They are markedly raised, definitely circular in outline and translucent. The hemolytic zone appears light in transmitted light and dark in reflected light.	Colonies are flat, transparent and irregular in outline; they are often umbilicated or show a slight elevation at the center. No hemolysis as a rule. Medium has a greenish hue.

Morphology

A small, ovoid, Gram-negative, nonmotile bacillus which stains feebly; bipolar staining is often present. In frequent subcultures the bacilli are more coccoid and stain more deeply. There is little tendency to pleomorphism.	A small, Gram-negative, nonmotile bacillus which shows a marked tendency to pleomorphism.

CULTURAL CHARACTERISTICS

Ascitic Agar

Visible growth in four days if surface of medium is broken with loop when slant is inoculated.	Does not grow.

Chocolate Agar

Grows poorly, if at all, in transfers made from original plate.	Grows well.

Plain Agar

Will grow slowly if accustomed to gradually decreasing amounts of blood.	Does not grow.

Viability

Viable at end of a month of cold storage. In some instances viable at end of six months.	Dies out in about a week of cold storage.

(Rich has recently pointed out that *B. pertussis* does not ferment dextrose, nor does it produce indol or reduce nitrates; *B. influenzae* does.)

EXPERIMENTAL PERTUSSIS

Jochmann-Hegler's *Infektionskrankheiten* has been, for many years, the accepted Continental standard. In the last (1924) edition there appears on page 344: "The etiologic microorganism has not yet been determined with certainty. . . . At present, the influenza-like bacillus, described by Bordet-Gengou is suspected, because it is the only bacillus which shows a biologic relationship with the serum of convalescents (agglutination and complement fixation). One must be cautious in drawing conclusions because such serologic reactions may manifest only a casual interplay between bacillus and body, without furnishing any proof of etiology. The bacillus might occur as a secondary infection. Another factor which speaks against the bacillus is its transient presence (only in the catarrhal and earliest paroxysmal stages), and its absence during the height of the disease. As in the case of influenza, one is tempted to assume that the cause of pertussis is an unknown virus, and that the Bordet-Gengou bacillus is a secondary invader." Regarding experimental pertussis they say: "It is doubtful whether typical pertussis can be produced in animals, for pertussis is a human disease." A review of the literature showed that only the experiment of Inaba at Tokyo University had withstood the test of time. But he had made no preliminary complement fixation or agglutination tests on

his young rhesus monkey. Nor had any blood counts, preliminary throat culture, or autopsy been performed. No subsequent worker had been able to duplicate his experiment, nor those of the Russian, Klimenko, working with puppies. Theobald Smith, among others in our country, concluded that the coughing puppies of Mallory and coworkers had distemper, not experimental whooping cough.

Before inoculating our recently imported young rhesus and ring-tail monkeys, detailed preliminary observations were undertaken.[3] During the weeks of acclimatization, repeated white cell and differential blood counts, rectal temperatures, hemoglobin readings, and throat cultures were made. Diagnostic tuberculin tests were negative. The preliminary leucocyte counts showed wide variations; the differential counts appeared less variable. The rhesus monkeys showed, as a rule, higher counts than did the ring-tails. The blood of each animal showed an individual range of fluctuation. When a leucocyte count was low, it seldom exceeded 7,000 per c.mm.; if high, the count usually ranged between 14,000 and 20,000 per c.mm. To eliminate controllable factors, the blood was always taken from visible skin veins of the ears, in the morning before feeding; individual pipettes were used for each animal, and the counts were usually checked by two observers. An average leucocyte and differential count was thus established for each animal before an inoculation, during the first week of a cough, and after the cough had subsided (whenever a coughing animal was not sacrificed).

On eight occasions healthy young animals were intimately exposed to children in the paroxysmal stage of the disease (cough plates still positive), or freshly coughed-up mucus was swabbed into the nose and throat of the animals. In seventeen tests, a twenty-four- to forty-eight-hour surface growth of recently isolated *B. pertussis*, suspended in several cubic centimeters of physiologic sodium chloride solution, was swabbed on the pharynx and dropped into the eyes and nose. In twenty-one tests the suspension was dropped into the nares after a slight asphyxia had been produced by pressure on the mouth and nose. In thirty tests saline suspensions were injected through the ventral wall of the larynx, with the needle directed downward.

Eight of the twenty-six tests (28 monkeys, 32 strains of *B. pertussis*) were followed in from seven to twenty days by coughs which usually became paroxysmal. Besides other control tests, injections were repeated in some of the animals which had recovered from the cough. In no instance could a cough be induced by such control tests. The characteristic, transient leucocytosis and lymphocytosis were detected only when the cough was at its height. The bacillus was recovered from deep throat cultures; also from the larynx, trachea and lungs after death. The bacillus was recovered during the cough from an animal, inoculated with the bacillus which had been recovered from the lung of another coughing animal which had been inoculated some time be-

fore. Animals which recovered were immune to subsequent overwhelming doses of various strains.

Conclusion

Healthy young monkeys are not very susceptible to *B. pertussis* infection. A transient, paroxysmal cough with vomiting of mucus followed inoculation or injection of *B. pertussis*, after an incubation period of seven to twenty days. This was noted in eight of seventy-six tests. The characteristic, transient pertussis blood picture was present during the height of the cough. The bacillus, recovered from an inoculated, coughing animal, produced the disease in another inoculated animal. Immunity was apparently conferred.

SITE OF THE LESION

Students of pertussis have long searched for the site of the lesion. Mallory and Horner, in 1912, described Gram-negative bacilli between and upon the cilia of trachea and bronchi in fatal pertussis and in puppies injected with *B. pertussis*. Although what they describe is not a lesion, textbooks have adopted their illustrations. Pospischill always maintained that the disease is anchored in the lung. In 1927, Feyrter, pathologist in the same hospital, published a monograph on the pathology of the lung in pertussis. His work was based on 225 postmortems, in 100 of which stained sections were studied. He says: "Pertussis bronchopneumonia has its origin in pertussis bronchiolitis and peribronchiolitis. . . . The lung becomes diseased early in the course of the disease." L. Smith, of Boston, in the same year, found *B. pertussis* in pure culture in the lungs of 7 of 8 fatal cases.

Our work on experimental pertussis provided exceptional material for bacteriologic and pathologic study, not only in fatal pertussis bronchopneumonia, but, what is of far greater interest, the pathology of benign pertussis.[4] The regional bacteriology of larynx, trachea and bronchial tree was studied from stained smears and from cultures, obtained before the body heat had left the sacrificed animals. The regional histopathology was studied from fixed and stained sections. Some of the animals were recovering from the paroxysmal cough, others were killed or died with pertussis bronchopneumonia. The respiratory tracts of several infants with fatal pertussis bronchopneumonia were also studied. Search for the region with the most profound injury in the benign, the fatal experimental and the fatal human pertussis invariably centered in the finer bronchi and bronchioles. Endobronchitis and peribronchitis were more pronounced in the benign type. *B. pertussis* were recovered in pure culture from the finer bronchi and were seen in sections of bronchi and bronchioles in the animals sacrificed during recovery. In the experimental pertussis bronchopneumonia and in the fatal human pertussis bronchopneumonia, *B. pertussis* was recovered from bronchi and bronchioles and was seen in sections of bronchi, bron-

chioles and alveoli. Endobronchiolitis and peribronchiolitis predominated throughout the pneumonic areas. Not only do these findings agree with Feyrter's and Smith's in fatal pertussis bronchopneumonia, but they bring bacteriologic and pathologic evidence that Pospischill's clinical views regarding the lung in benign pertussis is correct.

Conclusion

The site of the lesion in benign experimental pertussis is in the finer bronchi (endobronchitis and peribronchitis); in experimental pertussis bronchopneumonia and in fatal human pertussis bronchopneumonia, endobronchiolitis and peribronchiolitis predominate.

THE WHOOPING COUGH BLOOD PICTURE

Textbooks tell us that whooping cough is the only disease of the respiratory tract in which leucocytosis and lymphocytosis occur. Clinicians are very often perplexed, however, by the blood picture, and not a few have found it misleading. Seeking the cause for this discrepancy, repeated leucocyte counts and differential counts were made on seventy pertussis patients.[5] The greatest variations were found in the catarrhal and decline stages. In many the counts were not typical until the paroxysmal stage was definitely established. Initial leucopenia was noted in 7 of 10 cases in which repeated counts were made, some days after exposure, but before catarrhal symptoms were manifest. It seems to be an integral part of the early blood changes. In only four of the twenty-five cases in the catarrhal stage was the count above 15,000 at the time of the first examination. Low, misleading counts, made early in the catarrhal stage, when compared with the count a week or two later, showed striking contrasts. Leucocytosis and lymphocytosis were always found when the paroxysmal stage was at its height, and persisted during the first week of the decline period. When the cough had almost subsided completely, a leucopenia preceded the return to the normal blood picture. The differential counts at this time showed a decrease in lymphocytes. After this initial and terminal leucopenia had been found, the protocols of our experimental pertussis monkeys were studied. Five of the seven animals which developed paroxysmal coughs and lymphocytosis showed an initial leucopenia, and three of the four not sacrificed for histologic study showed a terminal leucopenia. This may serve as further evidence that the coughs in the monkeys were due to infection with *B. pertussis.*

Conclusion

The blood picture is seldom an aid in early diagnosis of whooping cough. Leucocytosis and lymphocytosis are usually present when the paroxysmal stage is well established. It is hazardous to exclude pertussis on the basis of a blood examination that fails to show these changes.

THE BACTERIOPHAGE OF B. PERTUSSIS

In 1928 there appeared in the Paris letter of the *Journal of the American Medical Association* a report on the use of *B. typhosus* bacteriophage in skin tests and immunization against typhoid fever. As we had met with failure in our attempts to perfect a skin test with Berkefeld and Chamberland L 3 filtrate dilutions of *B. pertussis* cultures, the technic for the isolation of bacteriophage was studied.[6]

A rough type colony (strain C) was selected for use in the search for the bacteriophage of *B. pertussis*. A similar colony from another strain (No. 32) was chosen so that the work could be carried out in duplicate. These cultures had been maintained for years by bimonthly transfer, and the rough type colonies were discovered after many weeks of plating and diligent search by Miss Hambrecht. The two rough colonies were grown respectively in flasks containing 30 c.c. of bouillon, to which had been added from 1 to 2 c.c. fresh, defibrinated blood. After five days' incubation the contents were filtered (through filter paper impregnated with sterile infusorial earth) until clear, then passed through sterile Chamberland L 3 candles. The respective sterile filtrates were added to new flasks of bouillon, blood and bacilli. After five days' incubation the process was repeated. Examinations were made by spreading a loopful of the liquid on Bordet-Gengou medium; the incubated plates were examined daily for plaques. While these rough strains were thus grown in their own filtrates, other flasks were left in the incubator for three or more weeks, during which time they were observed for clearing and repeatedly tested for plaques.

While this work was in progress other methods, recommended for the isolation of bacteriophage, were pursued. The intraperitoneal injection of *B. pertussis* in guinea pigs; the addition of 5 per cent pancreatin to liquid cultures of *B. pertussis*, as recommended by Hadley; the addition of filtrates of excreta and expectorations (from various whooping cough convalescents) to liquid cultures of *B. pertussis* all failed to yield a bacteriophage. According to the technic of G. Smith of d'Herelle's laboratory at Yale, a strong bacteriophage for *B. pertussis* was readily secured. To nine parts of fresh (L 3) sewage-filtrate, one part of concentrated (ten-fold) bouillon was added. To 30 c.c. of this sewage-bouillon six drops of blood and the growth from a twenty-four-hour slant of *B. pertussis* were added. There was evidence of clearing after the third day of incubation, and platings gave abundant plaques. A duplicate tube, set up at the same time, but containing autoclaved sewage-filtrate, was subjected to the same procedure. Platings made from both tubes at the time of inoculation gave smooth, even areas of growth. The tube of sterilized sewage remained cloudy and never gave any evidence of plaques. From a bacteriophage, procured by this method, lysis was transmitted in series and occurred in a 10^{-6} dilution.

Young cultures of our old strains developed bacteriophage when tested by this method. All of these races of bacteriophage were active against the "C" culture. The "C" bacteriophage, in turn, was active against young cultures of all of the old strains.

Conclusion

B. pertussis bacteriophage was procured by growing young cultures of old strains of *B. pertussis* in a concentrated, fresh sewage-bouillon which contained a small amount of defibrinated blood. Lysis was transmitted in series; and platings, made from such lyzed tubes, gave evidence of plaques.

IMMUNIZATION

No other communicable disease of early childhood varies in duration and severity as does whooping cough. The mortality in afflicted infants is about 15 per cent; after the fourth year, it is about nil. Although it may be benign, even in the young infant and frail child, the younger the child, the more likely will the course be serious. The average age, computed from 400 private patients, was found to be about four years. Because there is a natural variation in the duration and severity, evidence in favor of vaccine therapy has long been under suspicion. There are no satisfactory controls. When the vaccine seems to work, it is possible that the case would have been mild without vaccine, or, that the cough in question was not pertussis. These facts should justify the following attempt in whooping cough immunization.

Between 1928 and 1933 over three hundred young, nonimmune children were each given hypodermically a vaccine containing between 70 and 80 billion bacilli.[7] Over 1600 injections were given. In no instance was a severe local or systemic reaction noted. The vaccine was prepared by Miss Hambrecht. Five to seven strongly hemolytic, recently isolated strains of *B. pertussis* were grown on Bordet medium, made with human blood. A fresh supply was made every few months. The forty-eight-hour growth was scraped off and suspended in 0.5 per cent phenolized normal salt solution. When sterility and purity were insured (after a week in the refrigerator) by culture on three successive days and examination of stained smears, it was diluted with 0.5 per cent phenolized normal salt solution so that 1 c.c. approximated 10 billion bacilli. Syringes and needles were sterilized in the hot oven. A total of 7 to 8 c.c. was given to each child.

Group A (1928) consisted of 109 young children whose past histories were known to me since their infancy. About 1 c.c. was given into and just under the skin in alternate arms each week until a total of 8 injections had been given. The deltoid and biceps regions were used; injections were never given in the same area (to avoid the phenomenon of Arthus).

GROUP B (1929 to 1930) consisted of 97 similar young children, but 1 c.c. was given simultaneously in each arm, i.e., the injections were completed in four weeks.

GROUP C (1931 to 1932) consisted of 88 similar nonimmunes, who received the same total amount of vaccine, but the injections were completed in three weeks, i.e., 1.0, 1.5, 1.5 c.c. were given into both arms each respective week.

The induration and redness at the site of injection seldom exceeded 5 cm. The tenderness was most marked after the second and third injections in Group C. The subcutaneous nodule persisted longer, but decreased from week to week and was entirely gone within six weeks after the last injection. The rectal temperature in several reached 102°, in a few it went to 103° eight to twelve hours after the injections, but it was invariably normal by the end of the second day. Never could the local or systemic reaction be compared in severity with the mildest smallpox vaccination reaction. Never did a vesicle, pustule or infection of the skin occur.

To determine whether the vaccine induced a change in the blood picture, leucocyte counts and differential counts were made. In 78 children counts were made before the first injection; in 93 of Group A, and in 85 of Group B counts were made just before the final injection. Most of the counts were made by Miss Hambrecht. The average leucocyte count before the first injection was 10,514; the average count on the day of the eighth injection in Group A was 14,915; the average count on the day of the fourth injection in Group B was 16,540. The differential counts showed that the rise, in most instances when it occurred, was due to an increase in the small lymphocytes. In over 60 per cent was an increase in the count noted. The highest leucocyte count in Group A was 30,000; in Group B it exceeded 32,000 per c.mm. The vaccine seemed to influence the blood picture as does whooping cough.

Evidence of immunization conferred by these injections has been collected in the course of four years. It consisted of cohabitational (familial) exposure and transient (probable) exposures. Under the former there occurred 8 instances in 5 families with six nonimmune controls. All of the six controls (and a mother) contracted unquestionable whooping cough two and one-half to three years after the injections. They had positive cough plates, paroxysmal coughs and lymphocytosis. The injected had been most intimately exposed to their coughing brothers and sisters during the entire incubation, catarrhal and paroxysmal periods. They were urged to play, eat and sleep with the infected members of their households. None of the injected children developed whooping cough. In one frail child whose injections had been completed about two months previously, a few bacilli were re-

covered, but her blood and clinical findings did not show pertussis. Commercial vaccines, made from old laboratory strains, should not be used.

CONCLUSION

Simultaneous injections of a fairly fresh pertussis vaccine into and just under the skin of both arms seem to confer immunity if the injections are completed at least three months before actual exposure to the disease. The vaccine should be made from 5 to 7 recently isolated, strongly hemolytic strains grown on human blood.

One c.c., 1.5 c.c. and 1.5 c.c. are given in respective weeks, into each arm. A total of 7 to 8 c.c. (70 to 80 billion bacilli) should be given in the course of three weeks.

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636 CHURCH STREET.

ACRODYNIA

Arsenic as the Etiologic Factor

Fritz Meyer, M.D., and Ellwood C. Weise, M.D.
Bridgeport, Conn.

THEORIES as to the etiology of acrodynia are as numerous as the names for the disease. Many factors have occupied the attention of investigators of this subject from time to time as to the etiology. Among those mentioned have been: avitiminosis, respiratory infections, arsenical toxicosis, borax poisoning, neurosis of the vegetative nervous system, allergy, grain fungi, and by one[1] as a cutaneous symptom of encephalitis. Names used to identify this disease have been: Pink's disease, Swift's disease, acrodynia, erythredema, and dermatopolyneuritis.

Arsenic has been mentioned by some writers as the probable etiological agent in acrodynia. Kernohan and Kennedy[2] claim that lack of evidence in favor of arsenical poisoning and neurosis of the vegetative nervous system has practically disproved these theories, although admitting at the same time that the evidence which has been brought forward in support of the infectious theory is in no way conclusive. Crawford,[3] in reviewing the literature mentions the Paris epidemic in 1827 and the English epidemic in 1900 as being due to arsenic, the former being traced to wine made from grapes which had been sprayed with a parasiticide and the latter to beer containing arsenic having its origin in contaminated dextrose.

It is of interest to note in the report of Bilderback's cases[4] that they occurred in patients who had been taking a generous diet of milk and vegetables and were from small farms or towns in Oregon. The question might be asked of those cases from Oregon (which is a large fruit-producing state), whether the apples and vegetables have been sprayed with an arsenical compound. Goodman and Marjorie Bun[5] admit that the epidemic of Paris, Brussels and England might have been due to arsenical poisoning, but believe that there is no supporting etiologic evidence between arsenical poisoning and the present acrodynia. No laboratory estimations for arsenic are recorded. A case in an adult reported by White,[6] which differed from the juvenile type in that the lesions involved the face, gave a negative test for arsenic in the urine. There appears to be no mention in the literature of chemical analysis of the blood for arsenic.

The authors believe their case of acrodynia with positive blood and urine arsenic determinations to be of interest.

REPORT OF CASE

H. A., a white boy, aged four years three months was carried into the office August 23, 1931, the chief complaint being that he was getting progressively weaker, irritable and losing weight since an attack of pertussis two months previously.

At this time the patient was listless, apathetic, whining, crying without cause and was too weak to walk or sit up. When placed on the floor he assumed the attitude of universal flexion. A physical examination which was difficult to conduct revealed nothing more than an emaciated child with a tachycardia of 180. Previously he had been a bright and cheerful child. When seen a week later he presented a picture of misery, would not smile or play, was very irritable and suffered from marked insomnia, profuse sweating, paresthesias, headaches, epigastric pain, pain along the extremities, itching and burning of the feet and hands which

Fig. 1.

were cold. A tentative diagnosis of encephalitis was made because of the symptomatology. Girard[1] believes that acrodynia is only a cutaneous manifestation of encephalitis.

The blood at this time showed hemoglobin 85 per cent, red cells 5,050,000, white cells 8,200, polymorphonuclears 56 per cent, lymphocytes 42 per cent, and monocytes 2 per cent. The Mantoux test was negative. When seen on September 9, 1931, there appeared a slight swelling and redness of the feet and hands. On the body an erythematous eruption was present which followed the distribution of the sweat glands resembling a toxic erythema (measle-like in type). The following week his hands and feet evidenced more swelling, especially the fingers and toes. There was a dusky pink, symmetrical discoloration of the hands and feet. The night sweats at this time were so profuse as to necessitate the changing of the bed clothing as often as five times a night. Insomnia was a troublesome factor insomuch as it did not respond to large doses of a phenobarbital compound.

When seen by one of us (E. C. W.) the suggestion was made that arsenic might be the etiologic factor. Subsequent blood analysis proved this to be the case. A blood arsenic determination on October 29, 1931, showed 0.102 mg. of arsenic per 100 gm. of solid.* Treatment was instituted and the urinalysis on November 21, 1931, exhibited 0.106 mg. of arsenic per 100 gm. of solid, and 0.029 mg. of lead per 1000 c.c. of urine. The hands and feet at this time were cold, dusky pink, desquamating with numerous ulcers between the fingers and toes. (Figs. 1 and 2.) Under treatment the child improved gradually and a urinalysis on January 18, 1932, showed 0.039 mg. of arsenic per 100 gm. of solid, and 0.015 mg. of lead per 1000 c.c. of urine.

Fig. 2.

Treatment consisted of the administration of graduated doses of sodium thiosulphate intravenously up to 1 gram weekly and 1.4 gm. of enteric coated Sulfactol (sodium thiosulphate) daily by mouth.

COMMENT

The symptoms in this case followed a respiratory infection, an incident which had been noted by others reporting this disease and was probably a coincidental factor. The great frequency of respiratory infections with such a small percentage developing acrodynia caused us to seek further for an etiologic factor. The finding of arsenic and lead

*Normal blood arsenic 0.030 mg. per 100 gm. of solid.

in the blood and urine leads us to believe that the inciting agent was arsenite of lead, a compound which has a common use as a paracitieide. The patient in this instance resides in the country and further inquiry brought out the fact that two dogs had died in the neighborhood and that the child was in the habit of playing in the dog kennels about this time. It is presumed that these dogs might have died of arsenical poisoning, the source of which, of course, was unknown. Of interest is also the fact that the patient had eaten raw and cooked beans which were planted next to potatoes which were sprayed with arsenite of lead. The other agents which were thought of as containing arsenic were, apples, wall paper, vegetables, feathers and the hair mattress.

CONCLUSION

A case of acrodynia has been presented which exhibited a high blood and urine arsenic.

Arsenic as the etiologic factor in acrodynia is again suggested and attention is called to the paucity of blood or urine arsenic determinations in cases of juvenile acrodynia.

The patient in our case improved just as rapidly as the blood cleared of arsenic.

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MEDICAL BUILDING.

ANTIQUES OF PEDIATRIC INTEREST

T. G. H. Drake, M.B., F.R.C.P.(C.)

THE name "Doll" is of doubtful etymology; by some authorities it is considered to be a corruption of Dorothy; according to another it properly means a plaything, from old Dutch "Dol"—a whipping top.

Egyptian dolls with wooden, paddle-shaped bodies painted in colors, the hair represented by beads of baked mud strung upon threads, have been found dating from about 1000 B.C. The Egyptian child also played with dolls made from rags and papyrus. Early Grecian pottery dolls have been found in children's tombs. These dolls have separate

Ancient Dolls

Roman doll, bone, found at Hawara, Egypt, height 13 cm.
Portion of doll, Cyprus, 800 B. C., pottery
Doll, Greece, circa 400 B. C., pottery

arms and legs which were articulated to the body by metal pins or strings. Without doubt, these specimens were meant to be dressed, the modelling of the head being much superior to those portions of the body which would be covered by the clothing. Occasionally a Greek or Roman doll is found carved from ivory or bone. In the sixteenth century, wooden or composition dolls were in vogue. Specimens of these

From the Department of Pediatrics, University of Toronto, and Hospital for Sick Children, Toronto.

which have been preserved are elaborately dressed in silks or satins, ornamented with lace and embroidered with gold thread and with human hair attached by wax to the head. In the seventeenth and eighteenth centuries, elaborately dressed fashion puppets or dolls were the forerunners of the present-day illustrated fashion sheets. At first these fashion dolls demonstrating the latest styles in dress, lingerie and coiffure were exhibited in Paris only, but in time duplicates were sent out to the other capitals of Europe in order that the fashions of those unable to visit Paris might be up-to-date. These fashion puppets were considered so important that even as late as the beginning of the nineteenth century in time of war they were allowed to pass when nearly all other objects were contraband.

As a rule the eighteenth-century doll ranged in size from seven to fourteen inches, though an occasional life-size doll is met with. Eyes which opened and shut by means of a counterbalance appeared first at the beginning of the nineteenth century. At this time the heads were of composition pressed into moulds, porcelain or wax; the arms and legs were of wood, and bodies of kid stuffed with sawdust had made their appearance. With the discovery of India rubber, dolls were fashioned from this material. The patent for the doll which could say mamma and papa was taken out in 1824 by a Parisian. The mechanism was worked by lifting one arm for one word, the other arm for the other word, the pressure of the arm working a kind of bellows concealed in the body. Unbreakable dolls, whose wax heads were covered with muslin, appeared about 1855.

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Critical Review

PROGRESS OF PUBLIC HEALTH AS IT RELATES TO THE CHILD

HAROLD C. STUART, M.D., BOSTON, MASS.

THE FIELD OF PUBLIC HEALTH

THE field of public health may be interpreted broadly to include all activities, agencies, or community conditions which affect the physical or mental health of the people. In this sense progress in public health is indicated by progress in any branch of medicine and in many other fields as well. It is dependent upon advancement of knowledge in the biologic, medical, and social sciences, upon growth of the social conscience and improvement in social institutions, upon improved standards of living with economic advancement sufficient to support these standards, and upon education of the public in matters of health. Interpreted in this sense a review of progress in public health as it relates to the child would touch upon most of the subjects covered in the other reviews appearing in this series. *Problems of the Newborn* and *Tuberculosis in Children* have already been reviewed, and yet progress in these fields is of vital concern to, and is in a considerable measure a reflection of, progress in public health.

In order to reduce the scope of this review and to avoid repetition, consideration is rather arbitrarily limited to community organizations and services, both official and nonofficial, which are of particular importance to children, if not solely for their benefit, and to the results which these have obtained as measured by mortality and morbidity statistics. Whenever public health is referred to without further definition it will be intended to include all such community enterprises which have as their objective the control of disease and the promotion of health. Even within this restricted field, it has been necessary to limit this first review to a rather general survey of conditions within the United States. It is hoped that with this background it will be possible in subsequent reviews to deal with more specific projects and to call attention to interesting developments in other countries.

Notable progress has been made in recent years in developing a more comprehensive philosophy of public health, in obtaining a better scientific understanding of the factors which determine both personal and community health, and in arousing a greater public interest in acquiring and maintaining health. These advances have made possible more unified and rational child health programs and a more ready mobilization of community resources for carrying them out. As a result there has been rapid improvement and extension of health services for children. Nevertheless, conditions are still far from ideal and in some sections they are lamentably unsatisfactory. The report of the Committee on the Cost of Medical Care,[1] in considering official services, states that "The United States spends only $1.00 per capita

From the Department of Pediatrics, Harvard Medical School, and the Department of Child Hygiene, Harvard School of Public Health.

for public health services to every $29.00 for other medical services. As a consequence public health service in the United States, both governmental and nongovernmental, is far from adequate, even in many large and medium-sized cities. In towns and rural areas it is usually rudimentary. Public health work does not attract so many well-qualified medical students as it should because tenure is frequently uncertain and subject to political influence and because lack of adequate financial support often makes the remuneration low and restricts the opportunities for effective work. Considering its potentialities for raising the general level of health of the people at relatively low cost, the public health service in the United States is very deficient." Not only are there marked sectional differences, but progress in the development of various branches of public health in any one community has usually been very uneven and has failed to follow a desirable sequence. There are usually wide differences between the extent and quality of services rendered to different age groups, and much waste commonly results from overlapping if not from rivalry between services. The provision of service has often outstripped any understanding of the nature of the service needed, owing to misguided enthusiasm on the part of leaders or to a public demand for action when there was no basis for sound action. In consequence many unwise practices have been initiated and much unnecessary or useless service rendered. In other instances public interest has been insufficient to carry through proved and urgently needed programs.

IMPORTANT CONTRIBUTORS TO PROGRESS

Advances in public health have usually been initiated by private agencies: either by organizations whose purposes were primarily for research and education, such as the larger "foundations"; or by those whose interests were primarily to meet specific local needs, usually either local organizations or local chapters of national associations. In many instances research or demonstration groups have started projects, sought the cooperation of local service groups, and later, having proved the effectiveness of these projects, turned them over to the local organizations to be carried as regular services. The federal and state governments have done a good deal in the way of demonstrating the value of health work for children. Many services started and wholly or partially supported by them in the beginning have later been accepted by local public or private agencies as enterprises worthy of their entire support. In addition, the whole child health movement has been given special impetus from time to time by certain exceptional undertakings, notably the Children's Year program of 1918 and the three White House Conferences of 1909, 1919, and 1930. A few outstanding examples of pioneer work may be referred to as evidence of different kinds of effort. This subject is more thoroughly reviewed in the report of the Committee on Public Health Organization of the White House Conference.[6(c)]

The Children's Bureau of the federal government has made extensive contributions to the science of child hygiene through the collection and interpretation of vital statistics, through national surveys, and through support of various research projects. With the financial support granted under the Sheppard-Towner Act it has been chiefly responsible for the establishment of state child hygiene services. The American Child Health Association has done much to develop prac-

tical technics for, as well as to popularize, child health work. It has assisted community groups working in the field by loaning personnel, rendering advice after conducting special investigations, and providing literature, rather than through grants of money. The *Health Survey of 86 Cities in the United States*[2] which it conducted during 1924 has proved an acceptable textbook for the teaching of public health administration and has afforded the basis upon which appraisals of municipal health activities are now made. Its *School Health Study*[3] conducted over a period of recent years possibly failed to provide as much constructive assistance as had been anticipated, but it did make a notable contribution in showing the unscientific foundations upon which much in the school health programs were based. The American Public Health Association has particularly concerned itself with standard methods and administrative practice, and offers a survey and appraisal service which is widely used.[4] The National Organization for Public Health Nursing has served much the same purpose in the field of nursing. Other national organizations and a few life insurance companies have been actively interested in promoting public health.

Among the foundations which have made sufficiently large contributions to alter materially the course of public health progress and to deserve special mention are the Rockefeller Foundation, the Commonwealth Fund, the Milbank Memorial Fund, and the Rosenwald Fund. One of their undertakings of special interest and value has been the "health demonstration"; that is, a field experiment in organization, administration, and service. These have been initiated and largely supported by the foundation, but carried out in cooperation with various local groups. The Commonwealth Fund, for example, has conducted four separate child health demonstrations. The primary purpose of these, as shown by Dinwiddie,[5] was to determine whether a sound and well-balanced public health program could be carried out in small cities and rural counties and could be incorporated permanently into the range of accepted tax-supported public services. The first demonstration was begun in Fargo, North Dakota, in 1923; and others followed in Athens, the county seat of Clarke County, Georgia; Rutherford County, Tennessee; and Marion County, Oregon. As a measure of the contribution these demonstrations made to the progress of public health in the communities in which they were located, the rating on the appraisal forms of the American Public Health Association may be given for each in the last year before the demonstration started and for the last year of the five year program. Fargo rated 32 per cent in 1922, 83 per cent in 1927; Clarke County 33 per cent in 1923, 89 per cent in 1928; Rutherford County 11 per cent in 1923, 81 per cent in 1928; and Marion County 20 per cent in 1924, 82 per cent in 1929. As a result there have been far greater reductions in mortality rates in these areas than in the states within which the units operated. Furthermore, the demonstrations did not prove to be temporary flares to die down when support was withdrawn, but in each instance the public continued to support through taxation a satisfactory public health program. An important accomplishment of the Commonwealth Fund's work has been to secure the goodwill and support of the practicing physician for the community program by bringing him into it.

The Rockefeller Foundation, through its International Health Division, has promoted the development of local health departments on a

county basis with full-time organizations staffed by well-qualified personnel. It has also been the most important influence in improving the training of public health personnel. Standards governing qualifications for public health positions are still very unsatisfactory, but there has been in recent years an increased realization of the need for well trained and high quality leadership. Much progress has been made toward meeting this need, largely through Rockefeller Foundation support. Two schools of public health have been established and seven departments of hygiene or preventive medicine within universities have been equipped to prepare public health officers adequately.

The recent White House Conference provided an opportunity for students in the many scientific fields which have a direct or indirect bearing upon child health to join together to evaluate the discoveries in their respective fields, to interpret these in terms of their application to child welfare, to discuss mutual problems, and to thrash out difference of opinion. Although not contributing much in the way of original studies, it assembled in usable form in a series of reports[6] the available knowledge in many fields. Undoubtedly the one to benefit most by the Conference has been the public health officer, for he has had the fundamental knowledge, the objectives and the methods of public health formulated for him, and he is now receiving greater public support, owing to an awakened interest in the protection of the health of children. Up to November, 1932, thirty states, one hundred counties, and eight cities had held follow-up conferences and others had been scheduled, indicating that the information collected by the national conference has penetrated to the local groups who must apply it. The work carried on by the follow-up committee of the Section on Medical Care under the direction of Dr. Hamill and by the American Academy of Pediatrics, indirectly an outcome of the Conference, has unquestionably awakened interest among physicians in the problems of preventive pediatrics and in a broader concept of the significance of health in childhood.

THE PHILOSOPHY OF PUBLIC HEALTH

To understand present trends in public health activities, it is necessary to appreciate the very fundamental change which has taken place in recent years in the concept of the purposes and functions of government in the field of health. These changes have been most clearly demonstrated in connection with services for children, in fact they have in large measure grown out of interest in the infant and child. The former purpose of attaining the health of the masses by the use of mass methods has been extended to one of controlling preventable diseases and disabilities in individuals by means of contact with and services for them. The former required little or no individual initiative or participation, while the latter requires an understanding cooperation. As a result of this extension of purpose there has developed an increased realization of the importance of public health education. The health officer has in consequence changed his primary rôle from that of inspector or police officer to that of educator, and his primary interests from those of sanitation and quarantine to those of preventive hygiene and health education. These changes were made necessary by a realization that the possibilities of health protection through mass methods were sharply limited and were rapidly being approached. They were made possible by an increasing public

realization that health is in a very real measure purchasable, that it is from the public standpoint worth what it costs on economic considerations alone, and that it is the foundation of the happiness and prosperity of the people. Its promotion is now generally recognized as an important function of government.

The realization that the infant and child are particularly responsive to environmental changes and preventive measures, but that their protection requires special methods, has led in recent years to the development of a separate branch of public health under the designation of "child hygiene." Child hygiene has come to be recognized more and more as a major concern of public health. This has led to an extensive study of the procedures by which the health of children may best be protected, and the means for making these available. There has resulted a clearer definition of objectives and methods, more effective types of organization, and some semblance of standardization of technic. The new activities, undertaken by public health agencies as a result of this broader concept of their responsibilities, have introduced many new problems in connection with the relation of public health to the practice of medicine. However, there is nothing in the newer philosophy which calls for the intrusion of public health into fields now covered by private practice, and responsible health officers are anxious to keep their activities dissociated from the practice of medicine.

PUBLIC HEALTH ORGANIZATION AND ADMINISTRATION

Federal.—The work of the federal government in behalf of child health is largely limited to research and education and is carried on under a number of different departments. The three chief agencies are the Public Health Service of the Treasury Department, the Children's Bureau of the Department of Labor through its Divisions of Maternity and Infant Hygiene and Child Hygiene, and the Division of Vital Statistics of the Bureau of the Census under the Department of Commerce. A number of other bureaus contribute in more limited or indirect ways, as incidental to undertakings in other fields. The majority of all federal health activities are conducted by the Public Health Service, but the Children's Bureau has been the most influential agency in stimulating the development of specific child health services throughout the country. The White House Conference Committee on Public Health Administration[6(e)] recommended that consolidation of federal health activities be provided for by congressional act, and specifically suggested that the health activities of the Children's Bureau, with certain exceptions, be transferred to the Public Health Service. This recommendation was apparently based upon sound principles of organization and not upon experience with the operation of the present system. A minority report disapproved of this change, owing to the inseparable relationship between child health and child welfare and the impossibility of a Children's Bureau ignoring health. Both agencies are in fact doing much for the health of children and with little reduplication of effort. The Children's Bureau has been notably successful in reaching the mothers of the country and in securing the cooperation of women's organizations in furthering local health projects. It publishes and distributes widely some of the best literature available to parents and lay groups on subjects relating to infant and child care.[7] As a result it is a very important force in the field of health education.

State.—Special divisions, bureaus or boards have been established within the departments of health in forty-seven states, since New York set the example in 1914. The Sheppard-Towner Act, through the means of "grants-in-aid" administered by the Children's Bureau, was largely instrumental in bringing this about. The recent Survey of Public Health in New York State[8] makes it clear that state health departments have become highly satisfactory units of government from the standpoint of activities, organization, administration, and qualifications of personnel. The commission had no recommendations to make as to changes in the New York organization, other than to appeal for better remuneration for its health officers.

It is generally conceded that the functions of the state in relation to child health work are best limited in so far as possible to the collection of information regarding health conditions and health needs, to providing expert advice and educational opportunities for local communities, to providing certain laboratory and other highly technical facilities including certain biologic products, and to demonstrations of health services. The state, according to present principles, should be of every possible assistance to small local units which find it difficult to provide adequate services, even to the extent of sharing their costs, but should, in so far as possible avoid direct or permanent responsibility for the conduct of local services. The absence or inadequacy of local organizations, particularly in rural and smaller urban areas, has made it necessary for many state health departments to become more and more operating agencies, contrary to this recognized policy. Most of them render little or no direct service in large cities or sections where there are well-organized county departments, but render most of the service that is available in other sections. The general tendency has been for the state from time to time to turn over services to local units which have become sufficiently strong to carry them, and to start similar services in weaker and neglected communities. Contact with local health units is usually made through district health officers or through special consultants connected with the state department. Information recently collected by the Children's Bureau relating to the expenditures of the various states for child hygiene during the year 1932 as compared with 1928 or 1929 reveals both the effect of the present economic stringency and the effect of discontinuing the Sheppard-Towner grants-in-aid. No recent figures were available from Arkansas, Delaware, Nebraska, Oklahoma, or New Mexico, but the data relating to the other forty-three states and the Territory of Hawaii were summarized by Oppenheimer[9] as follows:

"Nine states (Indiana, Maine, Maryland, New Hampshire, New Jersey, North Dakota, Rhode Island, Virginia, and Vermont) had appropriations for 1932 equalling or exceeding the combined state and federal funds under the Sheppard-Towner Act.

"Eleven states (Arizona, Georgia, Michigan, Minnesota, Missouri, Montana, Pennsylvania, Tennessee, Texas, Wisconsin, and Wyoming) and the Territory of Hawaii, had appropriations in 1932 which represented large increases over state appropriations made during the cooperation under the Sheppard-Towner Act, but do not quite equal the combined federal-state appropriations of 1928.

"Five states (Colorado, Kentucky, New York, South Dakota, and Washington) made appropriations which represent increases over state appropriations for 1928 but are considerably less than the combined state and federal funds for 1928.

"Twelve states (Alabama, California, Idaho, Iowa, Kansas, Louisiana, Mississippi, North Carolina, Ohio, Oregon, South Carolina, and West Virginia) made appropriations which were less than the state appropriations for 1928.

"Three states (Florida, Nevada, and Utah) have practically suspended child hygiene work; the Florida Bureau is temporarily suspended; in Nevada the only child hygiene work is done through the schools, and in Utah the work is practically confined to the distribution of literature.

"The appropriations in Connecticut, Illinois, and Massachusetts, which did not cooperate under the Sheppard-Towner Act, were increased in 1932 as compared with 1928."

Thus in 1932 as much or more money was spent on child health work as in 1928 or 1929 by twelve states, less was spent by thirty-one states and the Territory of Hawaii, and in three the reduction practically constituted discontinuance of state activities. It should be noted, however, that services discontinued have often been taken over by counties or local communities, and a number of states report the organization of new county health departments during these years. Furthermore, seventeen of the thirty-one states and the one territory having less funds available in 1932 actually appropriated more money than in 1931, in an attempt to compensate for the discontinuance of Sheppard-Towner assistance. Therefore, there were only fifteen states which had reduced their appropriations for child hygiene in 1932. There will undoubtedly be further reductions during the current year, but the record to date reflects a very general acceptance of child hygiene as an essential function of the state government.

A recent development in state activity in behalf of child health has been in connection with the emergency relief of the unemployed. An undertaking in Pennsylvania in this connection is of particular interest because it demonstrates the possibilities of state leadership in securing the cooperation of nonofficial or volunteer effort in behalf of a well-coordinated program. At the direction of the governor and under the leadership of Dr. Hamill an emergency child health committee has been formed, representing not only the State Medical Society but all organizations interested in the health of children and a representative from every county. The latter in each case heads a county child health committee. An extensive organization is being developed on a volunteer basis, consisting of physicians, nurses, and lay-workers for the purpose of giving health examinations and securing necessary health services. The children are brought by lay-volunteers to the offices of volunteering physicians for these examinations. There are one million children in families receiving emergency relief in Pennsylvania, and Hamill[10] reports that malnutrition has been increasing rapidly among them. It is hoped that, in addition to affording health service to those unable to pay, this movement will stimulate the demand for similar examinations on the part of those able to pay in part or in full. In New York the State Temporary Emergency Relief Administration has organized a nursing corps from the ranks of unemployed nurses on its relief rôles, and through them is providing health services for the children of destitute families.

Local.—Direct public health services are generally administered locally in the United States. The administrative unit is in certain instances a county, but more often it is a city, village, town, or combination of village and town. Existing services differ so enormously that classification or brief general description is impossible. In 1930 there were about one hundred cities with special child hygiene bureaus. About one-third of the total health department budget in most of these cities is specifically devoted to child hygiene. About 600 of the 3000 counties in the country have centralized health departments;

in most of the others public health responsibility is scattered among many local boards. Where county departments are organized child hygiene usually has a more prominent place in local programs than under village or town units, but with few exceptions child health work is not satisfactorily developed for the rural population of the United States, nursing service being the only one extensively available.

The report of the New York State Health Commission[8] summarizes the situation in that state and makes definite recommendations for improvement. It may be accepted as representing conditions the same as or better than in other states. It calls attention to the marked inequality of health service now being rendered in different communities and in the machinery for organized health protection against different conditions in the same community. These differences are due largely to the unevenness of popular sentiment for health action. As a result the report points out that tuberculosis is twice as prevalent in some counties as in others, and diphtheria has been stamped out in some municipalities while others still have a considerable amount of it. Twice as many babies die each year in some counties and cities as in others. There are in New York State 1158 town and village boards of health, usually with a part-time, inadequately trained health officer, supposedly providing the needed services for the control of infectious diseases, including tuberculosis and venereal diseases, for preventing deaths of mothers and safeguarding infant health, for the safety of public milk and water supplies, and for supervising public health nurses and a diagnostic laboratory. The New York Commission recommended the establishment of fifty-seven county boards of health to replace these inadequate and inefficient local boards. They pointed out that a far more effective health service could thus be provided with the expenditure of no more money. This recommendation expresses the most urgent need in connection with public health organization. The administrative unit need not necessarily follow county lines, but whatever unit is chosen it should be large enough to justify the employment of a full-time health officer with good training and qualifications, and for the establishment of a public health laboratory. Sometimes several adjacent small towns and villages can get together and give more efficient service than the county. However, a recent report by the Children's Bureau on an investigation of thirty counties having full-time health organizations indicates that maternity and infancy work is in large measure limited to prenatal and postnatal visits by generalized service nurses. In only half of these thirty counties was good medical supervision available for infant and preschool children in child health centers. Thus the mere presence of a county organization does not indicate that adequate service is being provided.

In summary, sound principles of public health organization call for a federal consulting, educational, and statistical child health service, dealing primarily with the states; and divisions of child hygiene within the state departments of health serving the local political units along the same general lines, but providing certain specific assistance of a kind not procurable with local resources. They dictate that control of actual services should be centered in sufficiently large population units to support a well-rounded organization, and yet sufficiently small to be close to the public served, the county usually being the best political unit. They call for full-time well-trained and well-paid personnel, divorced from the influences of political patronage. At present there

are too many small inefficient units, and much money is wasted on part-time poorly paid personnel. The sparsely populated rural areas offer the chief problem in providing adequate organization.

Nonofficial Service Organizations.—Public health services as now provided by governmental agencies would be totally inadequate if not supplemented by many private agencies. The report of the White House Conference on Administration[6(e)] lists the various nonofficial agencies and concludes that from twenty-five to thirty million dollars are spent by them annually, or about one-quarter of the total expenditures for public health. Most of the nonofficial agencies are local organizations but many are local chapters of the leading national associations. It is impossible to estimate how much of the work of these agencies reaches the infant and child, for many of their services are generalized. The nurses of the American Red Cross, the National Tuberculosis Association, the Metropolitan Life Insurance Company, and of large numbers of small local associations carry a large share of the public health work among mothers, infants, preschool and school children. Quoting from the same White House Conference report in connection with a study of fifty-nine cities' nonofficial agencies ". . . supply between 40 and 50 per cent of our public health nursing service and about one-fifth of our public health clinic service, varying from 10 per cent in the tuberculosis field to over 50 per cent in that of prenatal care. In activities actually performed, between 40 and 50 per cent of the appraisal scores for prenatal, infant, and preschool work were earned by nonofficial agencies." In addition, the grants-in-aid made by nonofficial agencies to official health organizations carry a considerable portion of their services. This intermingling of official and nonofficial agencies in the operating of activities necessarily leads to some friction and to much overlapping and inefficiency. Joint operation of services, however, offers certain advantages from the standpoint of leadership and quality and a greater freedom in the choice of forms of service. As the qualifications of health officers improve, there is a tendency for nonofficial agencies to work more and more under their direction or in conformity with their programs for community health, and this tendency should be encouraged by giving the health officer membership on all nonofficial boards.

A number of cities and counties have found the way out of the difficulties incident to multiplicity of agencies and lack of centralized control to be through a central planning committee, usually called a "health council" or "health league." All organized groups actively participating in any health service are represented on this central committee. The council studies local conditions, advises member groups, and appoints committees to develop suitable health services in fields where they are lacking. Some communities have gone one step further and established Child Councils which attempt to unify all efforts in behalf of children whether in the field of health, welfare, or education by bringing to the council board representatives of the leading organizations in these fields.

CHILD HEALTH SERVICES

The Relation of General Public Health Services.—All of the general public health services which aim to control community conditions for the protection of the health of the entire population make their contributions to the protection of children and some are of particular concern to them. A clean water supply, suitable sewage and garbage

disposal, inspection of food-handlers, and measures to limit the spread of insect and animal pests are all of vital concern to children. Although now generally of high standard, especially in urban areas, progress toward their perfection has been largely a matter of recent years. The most notable contribution in this respect from the child's standpoint has been the improvement in milk supply, and this has unquestionably been the most important factor in reducing the diarrheal diseases of infancy. Not only has the quality of milk progressively improved but the percentage of milk pasteurized has steadily increased so that at the present time most large cities require that all uncertified milk be pasteurized. Conditions in rural and small urban communities are not yet satisfactory, and in the nation as a whole much unsuitable milk is still taken by children.

The control of communicable diseases is also of particular importance to children. Here the lack of standardized procedures and the retention of unsound or useless regulations has been the chief element deserving criticism. The uniform and sound recommendations made by the Committee on Communicable Disease Control of the White House Conference[6(d)] should do much to impove this situation. Effective progress in this field has been made in connection with the early detection of tuberculosis and the discovery of incipient cases among home contacts. Many projects are now in operation along somewhat different experimental lines which should lead to a satisfactory procedure for general application in regard to tuberculosis. The knowledge upon which these programs are based has recently been reviewed by Opie,[11] and the program as carried out in Massachusetts by Pope.[12] Another activity under public health auspices deserving mention has been the setting up of machinery for the collection of convalescent sera. The state organization is well fitted to undertake this service when and where need arises. Although many other features of general health services are of importance to children, those provided for their particular benefit should focus our attention.

Maternal and Newborn.—The reduction of maternal morbidity and mortality is a matter of great concern to public health and is related closely to the health of children already born, as well as of those yet unborn. The final report of the Committee on Maternal and Infant Care of the White House Conference has not yet been published, but a preliminary report indicates that improvement in prenatal and natal care is largely dependent upon education of physicians, nurses, midwives, and the lay public alike. Prenatal care is not sought so extensively as infant care, nor is it as generally available, and of the services available relatively less is provided by official agencies. The forms of service which have proved of value are prenatal clinics under obstetric supervision and nursing visits during late pregnancy and the postpartum period, with nursing assistance during delivery. Better progress has been made in providing nursing service than medical supervision. There are nearly 50,000 midwives practicing in the United States, the majority of whom have had little training, and many general practitioners accept maternity cases after a very rudimentary obstetric training. It is not common practice for either of these groups to offer prenatal care, nor are public health clinics commonly available to their patients. However, many physicians and clinics are providing excellent services in these fields and interest in improving them is widespread. The importance of having consecutive and related prenatal, intrapartum and postpartum supervision is

being appreciated. The interrelationship between medical practice and public health in this field is a complicated one, but the need for the participation of the latter is obvious.

Infant and Preschool Child.—It is generally accepted that health supervision from early infancy to school entrance should be provided through a continuing and unified service. It is also generally agreed that this service must be a comprehensive and individualized one. When provided under public health agencies, it should be completely divorced from medical care, yet conducted in close cooperation with such care. Its primary function is educational, but it includes certain preventive procedures, principally the health examination for the detection of defects and incipient disease, and the accepted immunizations. To be effective it requires personal contact between parent, child, and a physician experienced in the care of children, together with nursing assistance at conference and in follow-up in the home.

The growth of infant health conferences throughout the country has been very rapid. Most of these conferences have been conducted by nonofficial agencies, but recently there has been a tendency for municipal governments to become responsible for them in the larger cities. The accepted principles of infant and preschool child health service have not always been adhered to in public health conferences. A few visits in early infancy followed by a preschool round-up have usually been considered adequate, thus neglecting the needs of the preschool child; there has been lack of continuity in the medical supervision; medical care has been introduced in certain quarters, and haste has commonly rendered the educational value of the work negligible. Too often attention has been confined to diet with neglect of other equally important aspects of child care. The selection of physicians to supervise child health in public conferences has offered a difficult problem. In small communities the health officer is the logical person to serve in this capacity, but too often he is not fitted to do so. In larger communities specialists in pediatrics are usually available. Many undesirable developments are avoided by securing for this purpose a physician who does not practice in the community served by the conference. The elimination of political patronage in municipally financed conferences is another important consideration. The city of Boston has solved this problem by placing the medical service in its child health conferences under the direction of the medical schools of the city. This has the added advantage of making them available for instruction in preventive pediatrics.

Under the auspices of the White House Conference Committee on Medical Care and with the assistance of many organizations and local groups, a cross-section of the Country was studied from the standpoint of the percentage of children under school age who had been vaccinated, immunized against diphtheria, or given a single health or dental examination. Questionnaires were also sent to certain local groups to determine local sentiment in regard to these subjects. The report of this survey[6(1)] is illuminating. As to public sentiment, it states: "Our information would indicate in general that there are abundant facilities for carrying out these recognized preventive measures throughout a large part of the country and that the supply is greater than the demand; that parents are interested in health examinations for their babies, but very much less so for the older children; that they are fairly favorable toward vaccination, and more so for the older children than the babies; and that toward diphtheria im-

munization they show slightly less interest, and then more for the younger than the older children." The actual figures as to the percentage of children including in the survey who had received the various types of health service may be briefly summarized as follows: Forty-nine per cent of all the children had been given at least one health examination, the range in different communities being from a high of 82 per cent to a low of 11 per cent. In general, a higher percentage of urban children had been examined than rural, rather more of those falling in high than in low income groups, but roughly the same number at each year of age. As to dental examinations, the figures cover only children of three, four, and five years of age. Eleven per cent of all had received one or more dental examinations, as high as 44 per cent in one community and as low as 1 per cent in another. There was a decreasing percentage with each lower economic group, an increasing percentage with age, but no difference between urban and rural groups. Thirty-one per cent of the total group of children had been vaccinated, the range being from a high of 48 per cent to a low of 2 per cent in different communities, and surprisingly few having been vaccinated during the first two years. The average rate in urban communities was three times as high as in rural areas, and the middle economic group showed the lowest percentage. Fourteen per cent of the total had been immunized against diphtheria with a high of 50 per cent and a low of 1 per cent, somewhat more in urban than in rural communities, and the percentage increasing slightly with age. In the highest economic group the percentage immunized was twice that in the lowest. There would seem to be little doubt that the enormous differences found in different localities reflect the adequacy of health service and public health education in these communities, and it should be of interest to any physician, as well as public health officer, to know how his particular community rated in this report.

School.—Progress in the extension and improvement of school hygiene has been in some respects more notable and rapid than in any other branch of child hygiene, although here again there have been striking differences between individual school systems. The greatest advance has been in the elementary public schools and in private boarding schools and colleges. In the latter, however, the program includes medical care as well as health service. Health programs in the high schools have been backward, although there is reason to believe that careful supervision is even more important during these years than during earlier school life. There has been, until the last three years at least, a steady increase in the expenditures for health work in the schools. There has come to be a better integration of the work of educational and public health authorities in behalf of the school child, and health principles are being more effectively taught in the classrooms. Physical education programs have been widely revised to conform with health needs; nutrition principles are now commonly applied in the school lunch rooms; rest during the school day is not so generally neglected; and mental hygiene is taking its place in education. There is no doubt that quite generally educators and parents have become more health-conscious in regard to school children.

Only recently have the principles and objectives of school health work been adequately formulated and they have not yet received general recognition. The modern thought in regard to school health problems is well expressed from the point of view of an educator by

Beatty[12] in the report of the School Health Conference held in Sayville, Long Island, in 1929. The White House Conference Committee on the School Child has reported[6(1)] its concept of desirable organization for medical service in the schools and has dealt with the duties and qualifications of the school physician. The report of another committee on *Appraisement of the Child*[6(c-iv)] takes up the purposes of school health service and explicitly limits them to the following: teaching children the rudiments of health and the factors which are important in maintaining health; protecting one child from acquiring disease from another; giving assurance that each child is fit for the routine to be imposed upon him; and finding defects or diseases which may impede school progress, with follow-up to secure the correction of those discovered. In the earlier days of enthusiastic extension of school health service there was often little thought as to the bounds of legitimate educational activities, and much corrective work of a definitely medical, dental, or surgical character was carried out by the schools within their own precincts. The schools are now limiting their activities more and more to the fields of protective and informative services. Under protective is generally understood to be included not only general sanitation, provision of suitable school plant and equipment, lunch rooms and menus, and the quarantine and isolation of contagious diseases, but also the protective immunization of children who have been so neglected as to reach this age without attention. On the informative side is not only included health education of a general character, but also appraisement of the individual child to determine his particular status and needs, and to bring these needs to the attention of the teacher or parent or at times of the child himself. In this connection emphasis is now wisely being shifted from height-weight relationships and hasty annual examinations to less frequent but more careful clinical appraisals. There is divergence of practice in different communities as to the auspices under which school health service is rendered. In some communities (in 75 per cent of cities of over 10,000 population) it is under the department of education, while in others it is under the department of health. Whichever maintains, it is most important that there be cooperation, for the medical aspects relate closely to the educational aspects. There should be close cooperation between the physical director and the health officer, and between the health officer and the family physician. It is also quite generally accepted as desirable that parents be present at school examinations.

The results of a survey of school health activities conducted in 1930 by the United States Office of Education, Department of the Interior, are summarized in *The School Health Program*.[6(1)] Although this showed evidence of progress along all lines in both urban and rural schools, it pointed out startling deficiencies. School physicians are rarely on a full-time basis and yet are on the average responsible for from 5000 to 6500 pupils, which precludes any possibility of adequately meeting the objectives outlined. Only 30 per cent of the larger cities report the examination of children before entrance to school and only 30 per cent report the removal of clothing to the waist at such school examinations as are provided. In 75 per cent of these cities no parents are present at examinations, and in the others relatively few attend. In the counties 30 per cent of the superintendents reported no one in charge of health work in their schools, and 50 per cent reported no general health examinations. Middle-sized cities (30,000 to 100,000) average an expenditure of eighty-one cents

per child on health work, while larger cities average sixty-seven cents, and smaller cities fifty-five cents. The other figures contained in this report lead to the conviction that progress has been limited to certain communities and that there is still room for marked improvement.

Special Handicapped Groups.—Suitable provision for the needs of physically handicapped children includes not only adequate support and education, but proper health protection and an opportunity to develop to their fullest capacities. The special problems from a health standpoint are the prevention of unnecessary physical and mental handicaps through the control of preventable diseases, injuries at birth and accidents during childhood, the early discovery of physical disabilities and the utilization of every possible measure to minimize their consequences, and the assurance of adequate health supervision through special means when required by particular disabilities. The report of the White House Conference Committee on *Organization for the Care of Handicapped Children*[6(s)] considers all these problems fully and reviews the very satisfactory progress which has been made in meeting them.

Another group of children who require and receive special public health attention are those who work. Not only must there be restriction of the fields in which minors may be employed, barring hazardous and repetitive fixed attention tasks, but there must be rigid control of the hours and conditions of such labor as is allowed, and there should be constant provision of real health supervision during employment. These ends are not in sight for the country at large, although certain sections are relatively free from serious child labor problems. The long-standing farce of requiring a physical examination by a physician prior to certification for employment has been given up in some communities in favor of more general supervision and of examinations held to a definite standard, and made by a physician appointed for the purpose. Again, a special report of the White House Conference is devoted to these problems.[6(o)]

A special form of handicap which in periods of stress like the present takes on very great public health importance is that of poverty of sufficient degree to threaten the provision of the necessities of life. Although primarily a social problem confronting the departments of welfare rather than health, it has very direct effects upon public health and calls for special public health effort. The health service makes its chief contribution to this problem by constantly stressing necessities, and teaching the public how to spend wisely in the purchase of food and other requirements. Public health nurses and nutrition workers have been of the greatest usefulness in this respect during the past two years and have greatly minimized the serious consequences of extensive unemployment. The present situation calls for increased vigilance on the part of all agencies providing child health services, in order to detect deficiency diseases quickly and to discover those suffering from real malnutrition. Unemployment has greatly increased the proportion of the population which may properly be considered indigent and has therefore greatly increased the burden upon those organizations which provide medical care and corrective services for children whose families cannot shoulder responsibility for their protection.

Public Health Nursing.—The effectiveness of public health work for children is in the last analysis dependent upon the ability and opportunities of those who apply it in the field. The public health nurse is

the central figure in many of the activities falling under the heading of child hygiene, and next to the health officer who plans and directs health service she is the most important figure. Her contribution has been a rapidly growing force for child health in this country during recent years. In many communities she has filled in the gaps in both medical and public health services with remarkable effectiveness, as for example under the Frontier Nursing Service. A résumé of public health nursing from the beginning to the present may be found in the *Social Work Year Book of 1929*.[14] Miss Tucker, of the National Organization for Public Health Nursing, in a personal communication has summarized the progress in this field as it relates to the protection of the infant and child, but space permits only the mention here of the main features of this summary. The present trend in nursing organization is toward a generalized service with activities in behalf of the infant and child administered and applied as part of the regular public health program. Thus service to the child is again becoming part of the broader service to the family and all contacts with the family are made by the same nurse. More and more of the funds necessary for conducting public health nursing services are coming from tax funds, although bedside nursing at the time of confinement and during the postnatal period is still largely a nonofficial service. A closer working relationship is developing between official and nonofficial nursing services, with frequent examples of pooling of funds or joint management. Between 1924 and 1931, according to the census of the National Organization, there was an increase from 11,171 to 15,865 public health nurses actively engaged in measures and services that protect the health of the child, and 4363 of these are giving all of their time to school nursing. The quality of their work has also greatly improved and the standards for its content have been scientifically reviewed in the revised *Manual of Public Health Nursing*.[15] The public health nurse is becoming more and more the liaison officer between the health department, the private physician, the school, the social agency, and the home.

Private Practitioner and Public Health.—It is generally recognized by leaders in the field of public health, although not always appreciated by other personnel of health departments, that the cooperation of the private practitioners of medicine is necessary for the success of most of their undertakings. The possibilities for the practice of preventive pediatrics on the part of general practitioners and the advantages of such practice from the standpoint of all parties are apparent. Lack of cooperation by physicians with child health services is commonly encountered and is due to many causes. These causes can usually be removed if there is sufficient community interest to bring both parties together in order to draw up satisfactory working relations. Many medical societies now have committtes on public health relations, and great progress has been made in the direction of better understanding.

The dependence of successful health supervision upon an intimate knowledge of the child, including his background, his home, and his health experiences, ideally calls for the provision of the medical aspects of this service by the personal or family physician. Much of the educational work and training in parenthood can, however, be successfully accomplished by a public health nurse under the direction of the health officer. The attempt to separate these two functions and to have public health education and private health supervision

carried on independently leads inevitably to conflict. The obvious solution would be to have preventive pediatrics provided for all but the indigent by private physicians in close cooperation with the public health nurse and other child hygiene agencies. Many health departments recognize the desirability of such an arrangement and are doing everything possible to cultivate such a working relationship. Until very recently, however, there has been little interest on the part of the medical profession outside of the specialty of pediatrics in providing preventive services for children, possibly excepting the regulation of feeding. This has led to different situations in different communities. In some the work has been left entirely to nurses and medical supervision has been neglected. In others a comprehensive preventive service has been provided under public health auspices through the agency of health conferences. In still others such conferences have invaded the field of medical treatment, often neglecting the service for which they were provided. The following statement made by the Director of the Commonwealth Fund[5-foreword] is of particular interest in this connection because of his intimate knowledge of the public health field and its contact with private practice. "As a result of its experience, the (Commonwealth) Fund has not only learned to appreciate the point of view of the private physician but has come to believe that the public health worker has sometimes expected more of him than, all things considered, is reasonable. Preventive medicine is only now beginning to be taught in our medical schools. Most of the physicians in practice in the United States, particularly in the smaller centers and in rural communities, have never had the opportunity to learn it. It is only comparatively recently that they have had opportunity to familiarize themselves with some of the principles of public health."

Recent graduates from medical schools are far more aware of the possibilities inherent in preventive medicine and the health needs of the infant and child; and those who are anxious to see preventive pediatrics provided by the private practitioner look with hope to entrance of this new blood into the field. The public demand for adequate health service for children has, however, been so insistent of late and it has met with so little response from the practitioners of medicine in many quarters that the health authorities are being forced to meet the need, and many of them now carry a heavy routine from which they would gladly be relieved. It is now an open question whether the tendency of recent years can be reversed, and whether this desirable field of service can be won over to the physician's private office where it logically belongs. It can only be done by his equipping himself to provide a better and more satisfying service in his office than is obtained in the public conference, and by his offering it at moderate cost.

MEASUREMENT OF PROGRESS

The measurement of the results of public health procedures offers the same types of difficulty as does the measurement of the benefits derived from medical care, but the factors involved are considerably more numerous and intangible. Progress is usually measured by a study of mortality statistics, morbidity statistics, statistical analyses of health appraisals, or by surveys of the availability and use of health services which are of measurable effectiveness. Examples of the latter have been referred to in connection with particular services.

Mortality Statistics.—Falling death rates may be attributed to many causes among which organized public health is simply one. Statistics based upon reported causes of deaths are never accurate, but they become more and more unreliable as the period of time over which comparisons are made is extended. For example, when one tries to determine the progress made in reducing the number of deaths due to prematurity or injury at birth one discovers that many deaths undoubtedly due to these causes in earlier years were recorded as due to debility, a diagnosis which is now rarely reported. Statistics drawn from the federal census are further complicated by a rapidly changing registration area, and it is quite impossible to estimate rates of

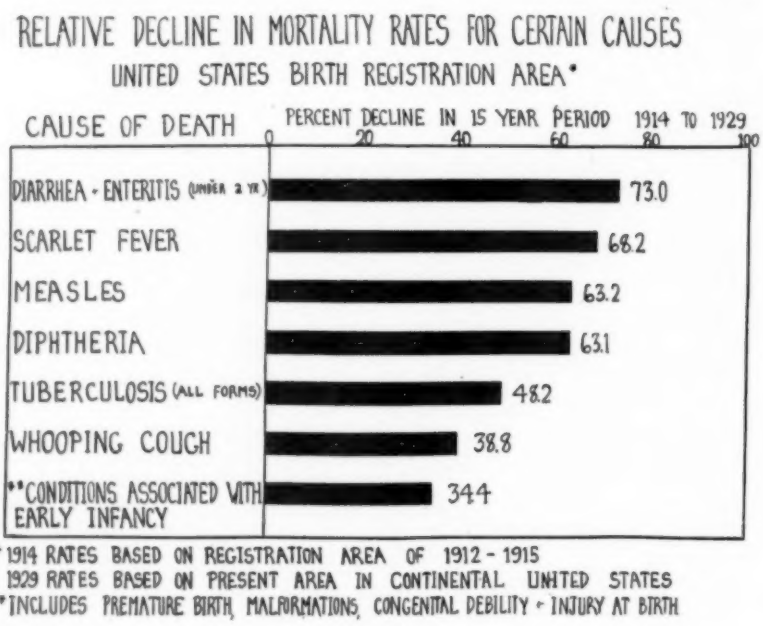

Chart I.

death from different causes by age periods, owing to uncertainty as to the age distribution of the population in different years throughout the registration states. It is possible, however, to select a few causes of death which are of importance in, if not entirely confined to, the early years in which the diagnosis at different periods should be roughly comparable, and with which public health effort has had much to do. Chart I shows the percentage of decline in death rates for such significant causes in the fifteen year period 1914 to 1929 for the expanding Birth Registration Area in Continental United States.

It is usually more satisfactory to study mortality statistics for a state or other limited area where conditions of recording and population are better known. Massachusetts has been chosen for this purpose and Charts II to IV show certain main trends in that state. Chart II gives the changes which have occurred since the beginning of the

century in total death rates among children of different ages. Errors in diagnosis are eliminated in this chart, and the population in the different age groups is quite accurately known, so it may be taken as a fair representation of the facts. Its interesting feature is the relatively high proportional reduction in all the years to maturity. Deaths during the various subdivisions of the first year are only available since 1916, but during this time they show no reduction under one week of age and little under one month, with a very rapid decline in late infancy. Chart III shows the almost complete obliteration of the summer rise in number of deaths due to diarrhea and enteritis since the beginning of the century, and Chart IV the almost comparable flattening of the tuberculosis curve in both the infant and the young adult periods.

Space will not permit an analysis of sectional differences in mortality rates and the possible relation of these to health services. It is sig-

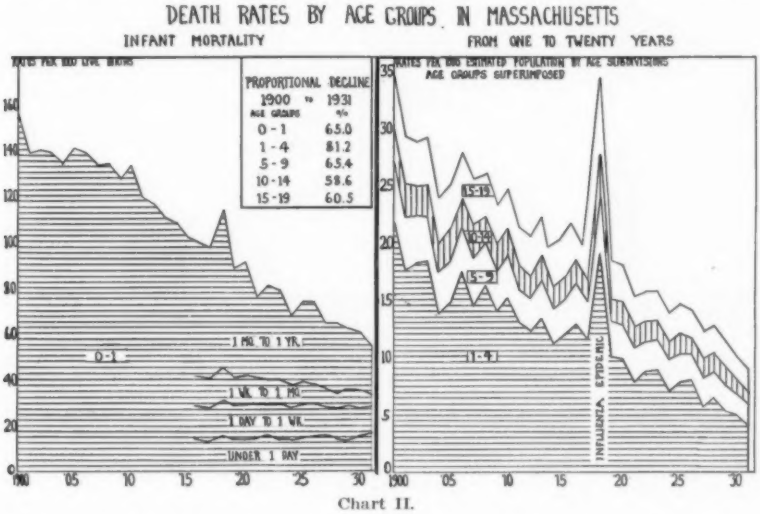

Chart II.

nificant that in general urban rates which used to be very high have fallen below rural in most sections. In New York City living conditions for a large percentage of the population might be considered very unfavorable for infant and child welfare but public health services are well developed. In the annual report of the New York City Health Department a series of charts are presented which show highly satisfactory progress.[16]

Morbidity Statistics.—It is very difficult to draw accurate conclusions as to the relative state of health of children at one period as compared with another, and still more difficult to determine the causes for any changes which are observed. The most easily accessible evidence of changing incidence of disease which bears a direct relation to public health effort is that given by reported cases of communicable diseases. A table recently received from the United States Health Service shows the number of cases of different diseases within certain specified groups of states in each year from 1925 to 1931 inclusive.

As might be expected there is a fairly constant decrease in the number of cases of diphtheria, typhoid fever, and all forms of tuberculosis, but a lack of definite trend in the other less easily controlled diseases. Smallpox showed an actual increase in 1929 and 1930 over all the earlier years, although it declined again in 1931. Surgeon General Cumming in submitting these figures called attention to the likelihood that during a period of economic stress and avoidance of unnecessary medical service many cases of communicable diseases will go unre-

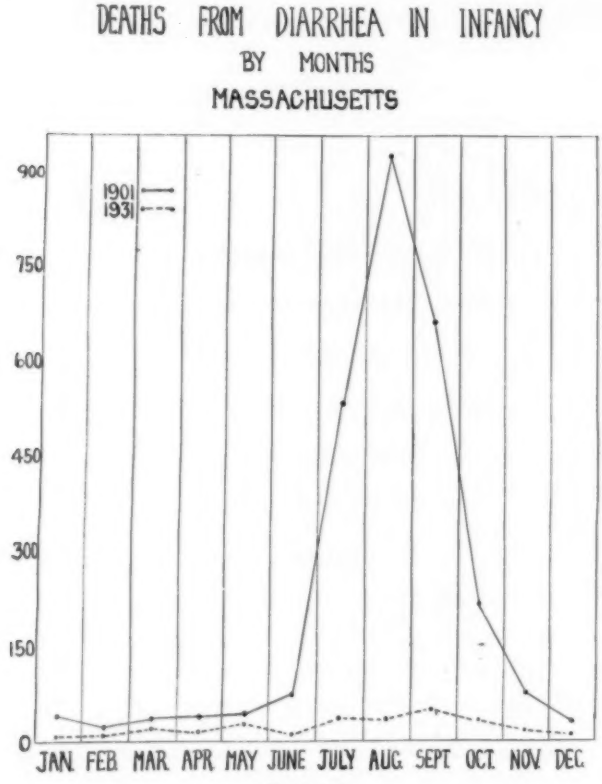

Chart III.

ported which would have been reported previously. On the other hand, figures going back over a longer period of years tend to confirm these general trends. It is possible to trace the relation between certain public health measures and changing morbidity rates in particular units of population, although one cannot assume that the relation is one of cause and effect. For example, a diphtheria prevention commission in New York City started a campaign during 1929 to secure the immunization of the child population of the city. Wynne[17] reports that during the preceding year there had been 10,776 cases of diphtheria reported and 642 deaths from this disease. In the year

1932, after three years of activity on the part of the commission, the number of cases had fallen to 3,585 and the number of deaths to 212. Bundesen[18] reports similar results from a campaign conducted on somewhat different lines in Chicago. A comparison of related years makes it unlikely that these differences are due to chance fluctuations.

A report of the Committee on the *Cost of Medical Care*[19] contains an interesting compilation of data dealing both with the extent of illness and the number of physical defects found among children in the United States. Certain schools have shown marked reductions in the number of children with defects as a result of intensive campaigns for

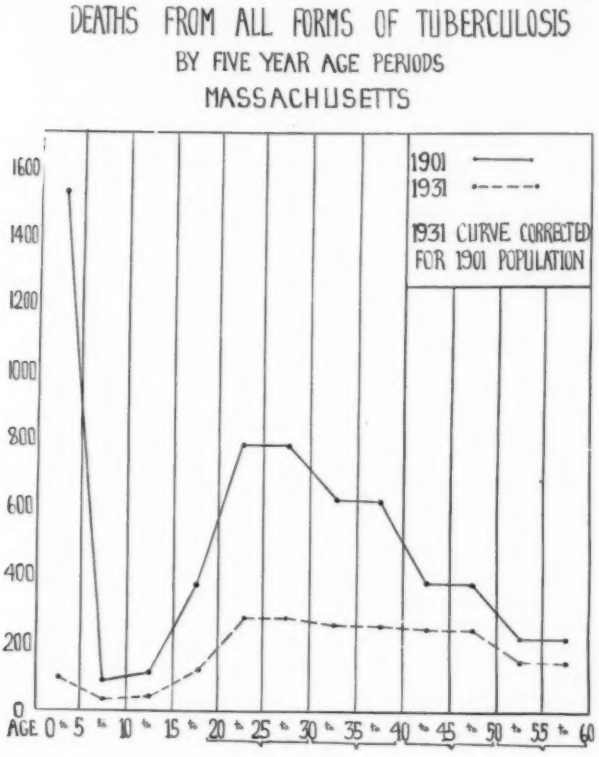

Chart IV.

their correction. On the other hand, a good many cities have recently reported a reversal of previous progress and an increasing percentage of malnourished school children. It is difficult to appraise the present situation and to know how serious the effects of the depression are proving to be. During the years of prosperity the American Child Health Association[3] found that 42 per cent of school children received less than one pint of milk a day, and the White House Conference Committee on the School Child[20] also found a surprisingly high percentage of inadequate diets. There is at present no sufficiently extensive evidence as to the influence of the depression upon the diets being

taken, although those working with the unemployed are keenly aware of their limitations. In attempting to measure malnutrition in population groups one encounters the great obstacle of lack of uniformity in methods of measurement and therefore lack of comparability of data. The Health Organization of the League of Nations, recognizing that this is a world-wide problem, called an international conference in Berlin in December, 1932, which drew up a plan for the medical investigation of the population,[21] avoiding the suggestion that malnutrition can be sharply distinguished from other effects of the depression. The information which has come to the writer's attention regarding the present incidence of malnutrition, although not uniform or representative of the country as a whole, indicates that poverty is making inroads into the health of the child population. It seems remarkable that concrete evidence of increased malnutrition and of a rising incidence of deficiency diseases has been so slow in appearing. This is a tribute to the effectiveness of organized services and an indication of the success of public health education. Dublin in his presidential address to the American Public Health Association in October, 1932,[22] made the following statement: "By and large, the health of the people as measured by the reports of sickness and death has never been better in spite of the fact that this is the third year of a severe economic depression. I am inclined to believe that the most important factor in the situation is the continued and effective functioning of the health departments, medical profession, and the social service agencies. . . . . Especially valuable has been the educational work that has been conducted for many years prior to the depression . . . . ."

CONCLUSION

In conclusion it might be broadly stated that public health services are nowhere able to perform the work fully which our present knowledge would justify. Many sections of the country still require much larger appropriations in order to maintain even minimum standards of health services. In places where the budgets approach adequacy, it is rather a matter of more intelligent and efficient use of the funds available. More money is undoubtedly spent by most American communities for sanitation and less for laboratories, nursing services, and for maternal and child hygiene than conditions would justify. Some states have so indiscriminately reduced budgets during the last year or two that important health services have been either seriously curtailed or absolutely thrown out of operation. However, most states have appreciated the following facts, as stated by Dublin:[23] "Health departments in our country have never suffered from inflation. Health officers have always been notoriously underpaid. Our health personnel has not been overextended. Therefore, in these times of stress such contraction as is possible in other services is not possible here, and it is poor policy indeed to save pennies and thereby throw out of gear services which conserve life and health."

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(d) Communicable Disease Control.
(e) Public Health Organization.
(f) Milk Production and Control.
(g) Organization for the Care of Handicapped Children.
(h) Body Mechanics, Education and Practice.
(i) Health Protection for the Preschool Child.
(j) Nutrition Service in the Field and Child Health Centers.
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News and Notes

The third annual meeting of the **American Academy of Pediatrics** will be held at the Edgewater Beach Hotel, Chicago, June 12 and 13, 1933. Professor E. Gorter will be the guest of the Academy and on Monday morning will discuss "Rickets—Dosage of Ultraviolet Light and Vitamin D Determination of Calcium in Bones In Vivo."

The Society of Pediatric Research met at New York City on May 6, 1933. The next annual meeting will be at Atlantic City, May 7, 1934.

The American Pediatric Society held its forty-fifth annual meeting in Washington, D. C., May 8, 9 and 10. The following officers were elected: Dr. Charles A. Fife, Philadelphia, President; Dr. S. W. Clausen, Rochester, New York, Vice-President; Dr. Hugh McCulloch, St. Louis, Secretary and Treasurer; Dr. C. A. Aldrich, Winnetka, Illinois, Recorder and Editor and Dr. S. G. Ross, Montreal, Member of the Council. This meeting was held in conjunction with the Congress of American Physicians and Surgeons of which the Society is a constituent member.

At the meeting of the Society, the report of the Committee on Medical Education of the American Academy of Pediatrics for the formation of an American Board of Pediatrics was discussed. Approval of the plan was given by the Society and Dr. Henry F. Helmholz, Rochester, Minnesota, was designated to represent the Society on the Committee of Three to organize the Board.

The next annual meeting of the Society will be held at Grove Park Inn, Asheville, North Carolina, in May, 1934.

The Babies and Childrens Hospital and the Maternity Hospital, members of the University Hospitals of Cleveland, have been temporarily closed because of scarcity of funds resulting from general and local financial conditions. Their activities will be carried on, on a reduced basis, in the new Lakeside Hospital and Hanna House buildings, the other members of the University Hospitals group, where the Departments of Medicine and Surgery have made room to accommodate Pediatrics and Obstetrics.

Book Reviews

Mental Deficiency Due to Birth Injuries. Edgar A. Doll, Winthrop M. Phelps and Ruth Taylor Melcher. The Macmillan Co., New York, 1932, pp. 289.

"Mental Deficiency Due to Birth Injuries" by Doll, Phelps and Melcher represents the results of a carefully executed study of the various psychological, mental and physical problems of children suffering from injuries of the central nervous system sustained at the time of birth.

The chapter dealing with the etiology of intracranial injuries describes the varieties of lesions and the predisposing causative factors, as well as the signs and symptoms that may appear immediately after delivery or at a later date. The literature dealing with this phase of the condition is reviewed and important factors are cited. The authors not only point out that intracranial injuries may not necessarily be the fault of the accoucheur but also emphasize that the attributing certain sequelae as the result of birth injury is dangerous for "the possibility of making a reliable diagnosis of birth injury from a physical examination alone is extremely uncertain."

The patients selected for this study comprised a group of twelve individuals whose age limits ranged from three to forty-one years. Selection of the patients was made on the basis of factors in the following order: "(1) Neurological diagnosis of cerebral lesion; (2) present symptoms; (3) family history; (4) birth history; (5) developmental history." Four of the patients had spastic paralysis, five had athetosis, one had a brachial palsy with macrocephaly and speech defect, one had excitability with no motor lesion and one had intention tremor. All of the patients had mental deficiency in association with their physical disabilities. In the cases in which a complete record could be obtained it was found that practically all of the subjects had shown delayed development in such acts as walking, talking and speech.

Chapter V, "Mental Tests and Measurements," consists of eighty-two pages devoted to a thorough discussion of the various methods employed in determining the degree of mental development of the patients. Care was exercised in finally selecting a means of examination that would give a fair idea of the child's mental status in the presence of physical handicaps. "What may be a test of natural ability for a child equipped with all the normal possibilities of physical response may prove to be a test of special ability for children with motor handicaps. . . . . it is easy to see how speed of performance, for example, may be a test of the efficiency of general adaptive ability of a normal child, but only a test of motor facility for our subjects, because their neuromuscular responses may lag behind their intellectual reactions." The Stanford-Binet, Myers mental measure, Goodenough drawing test, Porteus maze test and many other verbal and nonverbal tests were evaluated with the conclusion that the Stanford-Binet and the Myers "gave results of much practical value for purposes of determining the intelligence level of birth-injured subjects." A warning should be injected at this point. We must not assume without more evidence that the Stanford-Binet mental age will have its usual predictive value. The tests of the scale are largely tests of vocabulary and practical judgment. A person may be competent in these tests and still lack the associative capacity for reading, writing and arithmetic. The situation is somewhat analogous to the

individual who is suffering from aphasia; he may prove efficient in certain acts yet fail to be efficient as a whole. If mental efficiency in school tasks is seriously impaired by the brain injury then an "intelligence level" which masks this serious defect gives only a meager practical information about the mentality of the subject and may be very misleading.

Chapters VII and VIII, dealing with Mental Growth and Physical Therapy, suggest that the latter, when executed by one who is thoroughly familiar with the problems of the birth injured, will have a stimulating effect on the former and thereby facilitate mental growth. Patients suffering from dyskinesia are unquestionably improved by relaxation and as a result the performance of physical acts is greatly improved. Therefore when a re-appraisal of the patient is made by measures requiring motor activity the subject will show improvement. However this does not necessarily imply that an individual's mental capacity for education has been increased . . . the best test for this is the diagnostic test of teaching.

The book is well written and well prepared and should be of great interest not only to those who are devoting their efforts to the care and education of children suffering from birth injuries but to all pediatricians, for it will help them to intelligently direct the course of these patients.

R. CANNON ELEY, M.D.

The Child and the Tuberculosis Problem. J. Arthur Myers, Publisher: Charles C. Thomas, Springfield, Ill., October, 1932, pp. 230.

Generally speaking the value of a scientific book is in direct relation to the soundness of the author's views. Doctor Myer's association with Lymanhurst has given him a remarkable opportunity to observe tuberculous children in all stages of the disease over a period of years. Add to this the mind of a keen clinician and laboratory worker, an observer who sees clearly the problem as a whole, and one who possesses the ability to express himself logically and simply in the lecture room and with his pen, and one has a basis for an appreciation of the volume under review.

In recent years there has been accumulated much scientific knowledge concerning tuberculosis and the child. So rapid has been the accumulation of these facts and so diametrically opposed are some of the present beliefs to those formerly held that there is bound to be considerable "lag" in the dissemination of this knowledge even to the medical profession and its allied branches, not to mention the general public.

The author's purpose in presenting this book, as the reviewer understands it, is to bridge this gap, for so far reaching is the tuberculosis problem that little headway can be made until there is widespread application of known facts. And that this function has been fulfilled in a most admirable way, by the clear, logical, easily understandable, presentation is not to be doubted. Not only should the book be of value to physicians, nurses, public health officials, social workers, and school officials, but also the layman, possibly with a tuberculous background, should find in it a guide for his conduct to the mutual benefit of himself and his contacts.

The author discusses the present-day methods of discovering, controlling, and preventing tuberculosis among children in a general way.

More specifically the opening chapters deal with the communicable nature of tuberculosis and the various ways in which tubercle bacilli gain entrance to the body. The author stresses the fact repeatedly and at great pains that tuberculosis is a contagious disease, and as such is comparable to diphtheria and typhoid fever in its epidemiological control.

Chapters III and IV discuss the nature of childhood type tuberculosis and point out, among other things, that tuberculosis is not universal among children today; that a tuberculous child may be entirely free of symptoms; and that in the tuberculin test there is available an accurate means of detecting tuberculous infection.

Several interesting observations are made in the chapters devoted to tuberculosis in the "teen" age. In over half the cases seen with adult type tuberculosis at this age period a preexisting childhood type infection can be demonstrated. Immunity then is not established by first infection, but rather it sets the stage for development of the more serious adult type. By means of serial x-ray films it has been possible to demonstrate the beginning of an apical process years before the onset of symptoms. Complete physical examination, tuberculin testing, and roentgenology, are of great importance in this age group not only in schools but in the physician's private practice.

An outline for the conduct of a tuberculous survey is given in chapter VII, and the next chapter deals with the disposal of cases in the home, institutions, fresh air schools, preventoria, summer camps, etc.

The author reviews the work of the veterinarians, and acknowledges their contribution to the human problem by the example they have set in stamping out the disease among cattle. That some herds are now in greater danger from human exposure than from infected animals is a rather startling statement.

Chapter XII is devoted to a discussion of the tuberculous family and the method of studying and controlling the situation. Chapter XIII relative to the hazards of nurses whose duties expose them to tuberculous patients should be of great interest to the nursing profession. An example of rural community control of a tuberculosis situation by cooperation of physicians and veterinarians using modern methods is given in Chapter XIV.

The final two chapters consider the preventive aspects of the tuberculosis problem. School children must be protected from tuberculous teachers. The teaching of the basic facts underlying nutrition and health in the public schools tends to prevent health "fads." Fresh air may be as harmful as "fresh" milk, and "fresh" water. The school of the future will have filtered air, with controlled temperature, humidity, and circulation. Rest periods for energy conservation need greater emphasis in the schools. B. C. G. as a preventive measure is still of doubtful value.

It is to be hoped that this book will have a wide circulation, not only among the medical profession, but among the lay public as well, for it contains a wealth of information prepared by one who knows "whereof he speaks."

LEE FORREST HILL.

Comments

WE TAKE pleasure in announcing that the next number of THE JOURNAL OF PEDIATRICS will be a "Festschrift" in honor of the seventieth birthday of Adalbert Czerny. Some twenty-five of Professor Czerny's former American students and friends have written for the Festschrift. This issue will be approximately twice the size of a regular number and will contain only original communications. The Editorial Board feels that it is representative of American pediatrics. The proceedings of the meeting of the Academy in June, the annual Presidential Address, news notices, etc., will appear in the August issue.

AT THE meeting of the American Pediatric Society in Washington on May 10 favorable action was taken in regard to the formation of a qualifying Board of Pediatrics, by adopting the report published in the April issue of THE JOURNAL OF PEDIATRICS. The report will be taken up for action at the meetings of the Academy and the Section on Pediatrics of the A. M. A. in June. On the evening of June 11, before the time of these meetings, there will be a joint meeting of the National Board of Examiners, members of existing qualifying boards, and representatives of the Federation of State Board Examiners and the Council of Medical Education of the A. M. A. Representatives of the Academy Committee on Medical Education have been invited and will attend this meeting.

WITH this issue the Journal completes its first year. The Editorial Board wishes to thank the pediatricians for the generous support they have given and the tolerance they have shown toward its shortcomings. It took courage and optimism on the part of the publishers and Academy to launch a new medical journal in these difficult times. No one has as yet expressed himself to the effect that the need and place for The Journal has not been demonstrated. Its steady growth in readers, communications received, and as a choice on the part of advertisers has been most gratifying to those members of the Academy to whom the task of launching the Journal was entrusted. We repeat what we have said before. The Journal of Pediatrics is the journal of the American Academy of Pediatrics. Its value and success is the responsibility of the members of the Academy and not simply of the Editors and Editorial Board. So far but very few criticisms and suggestions for the Journal have been received. These are always welcome.

THE EDITOR who has been writing most of this column is wondering what he will have to say to provoke discussion and disagreement. Statements have been made with which many must disagree. Discussion has been requested. So far the only result has been letters agreeing with the viewpoint expressed. The idea comes to mind that perhaps only a few have bothered to read any of the "Comments." It was started with the idea of creating an open forum for the discussion of pediatric problems. There are problems we know. It was not intended as a column for any one or two individuals to air their personal views or try to put over ideas. We shall stick to it a little longer.

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